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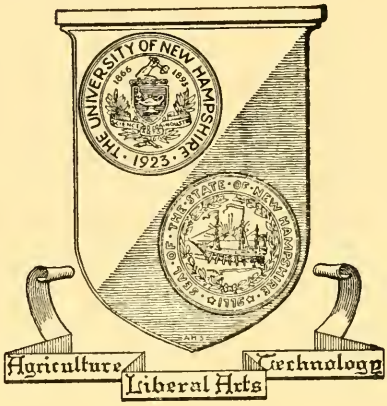

The University
of
New Hampshire

BULLETIN 363 NOVEMBER, 1945

Agricultural Research in New Hampshire

Annual Report of the Director of the
Agricultural Experiment Station
For the Year Ending
June 30, 1945

AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF NEW HAMPSHIRE
DURHAM, N. H.

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NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION STAFF

1945-46

ADMINISTRATION

M. Gale Eastman, Ph.D., Dean and Director
Harold C. Grinnell, Ph.D., Assistant to Dean Director
Raymond C. Magrath, Treasurer
Willis E. Littlefield, Purchasing Assistant
Ella S. Bowles, University Editor
Thelma Brackett, A.B., Librarian
Wilfred T. Harwood, Library Assistant in Charge, Plant and Animal Sciences Library

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Thomas G. Phillips, Ph.D., Chemist
Todd O. Smith, M.S., Associate Chemist
Stanley R. Shimer, M.S., Assistant Chemist
Gordon P. Percival, M.S., Assistant Chemist
Helen J. Purinton, Ph.D., Assistant Chemist
Arthur E. Teeri, Ph.D., Assistant Chemist
Henry A. Davis, M.S., Assistant in Agricultural and Biological Chemistry
Margaret Loughlin, A.B., Assistant in Agricultural and Biological Chemistry

AGRICULTURAL ECONOMICS

Harry C. Woodworth, M.S., Agricultural Economist
Max F. Abell, Ph.D., Assistant Agricultural Economist
Harold C. Grinnell, Ph.D., Assistant Agricultural Economist
Lawrence A. Dougherty, B.S., Assistant Agricultrral Economist
John C. Holmes, A.B., Assistant in Research in Agricultural Economics
George N. Bauer, Ph.D., Assistant in Agricultural Statistics

AGRONOMY

Ford S. Prince, B.S., Agronomist
Paul T. Blood, M.S., Assistant Agronomist
Leroy J. Higgins, B.S., Associate Agronomist
Louis T. Kardos, Ph.D., Assistant Agronomist
Betty G. Sanborn, Seed Analyst

ANIMAL HUSBANDRY

Ernest G. Ritzman, M.S., Research Professor Emeritus in Animal Husbandry
Albert D. Littlehale, Herdsman

BACTERIOLOGY

Lawrence W. Slanetz, Ph.D., Bacteriologist
Jean French, Laboratory Technician in Bacteriology

BOTANY

Albion R. Hodgdon, Ph.D., Plant Taxonomist
Stuart Dunn, Ph.D., Plant Physiologist
Mathias C. Richards, Ph.D., Plant Pathologist
Richard C. Jones, M.S., Research Assistant in Botany

DAIRY

Kenneth S. Morrow, M.S., Dairy Husbandman
Herbert C. Moore, M.S., Assistant Dairy Husbandman
Harry A. Keener, Ph.D., Assistant Dairy Husbandman
Albert D. Littlehale, Herdsman

ENTOMOLOGY

Walter C. O'Kane, M.A., D.Sc., Entomologist
James G. Conklin, Ph.D., Associate Entomologist
Wallace J. Morse, B.S., Research Assistant in Entomology

FORESTRY

Clark L. Stevens, M.F., Ph.D., Forester

HOME ECONOMICS

Barbara Connor, B.S., Assistant in Research in Home Economics

HORTICULTURE

Albert F. Yeager, Ph.D., Horticulturist
L. Phelps Latimer, Ph.D., Assistant Horticulturist
Henry S. Clapp, M.S., Assistant Horticulturist
William W. Smith, Ph.D., Assistant Horticulturist
Winfred D. Holley, M.S., Research Assistant in Horticulture
Russell Eggert, M.S., Research Assistant in in Horticulture
James Macfarlane, Greenhouse Assistant

POULTRY HUSBANDRY

T. Burr Charles, M.S., Poultry Husbandman
Fred E. Allen, D.V.M., Veterinarian
Alan C. Corbett, D.V.M., Assistant Poultry Pathologist
Richard C. Ringrose, Ph.D., Assistant Poultry Husbandman
Richard Ford, Assistant Technician in Poultry Husbandry
Donald A. Cross, Assistant Technician in Poultry Husbandry
Ruth E. Rinta, Assistant Laboratory Technician in Poultry Husbandry
Edwin T. Bardwell, B.S., R.O.P. Supervisor

ASSISTANTS TO THE STAFF

Beatrice M. Richmond, Cashier
Maisie Burpee, Clerk
Theresa R. Batchelder, Mailing Clerk
Martha E. Fisher, Stenographer
Kathrina H. Legg, Stenographer
Amber H. Hall, Stenographer
Sara M. Sanborn, Stenographer
Laverna E. Murphy, Stenographer
Edith M. Smith, Stenographer
Rosamond R. Ferry, Stenographer
Adrienne Girard, Stenographer
Claire E. Girard, Stenographer
Dorothy I. Noyes, Stenographer
Bernadine E. Davis, Stenographer
Mary V. McNeill, Stenographer
Grace L. Horne, Stenographer
Mildred Fullington, Stenographer
Gloria Chagnon, Stenographer

The War Continues

AGRICULTURAL RESEARCH is still carried on in New Hampshire with every consideration for special wartime needs that may hasten victory. Having had some taste of partial victory, at least in Europe, the postwar problems begin to take form in reconsidering and re-emphasizing long-time and general research that may contribute to continuously improved plants and animals and ever-increasing efficiency in the production and processing of such end products as may contribute to human welfare.

In the following pages, among the brief descriptions of research activities for the year past, such investigations as the following titles suggest might be mentioned as having some specific relation to war. A study of every-other-day delivery of milk grew out of a very definite war need for saving gas, tires, and human labor. Likewise the "Colebrook Plan" received further study and adjustment for the same purposes in a different phase of milk marketing.

Studying factors affecting the nutritive values of New Hampshire-grown fruits and vegetables fits into a nation-wide effort to learn more about the effects of processing on the nutritive values of human food. Never in the history of the world has the transportation and translocation of food been so important. The necessary processing for shipping and holding all kinds of food under all conditions of climate to prevent not only decay and putrifaction but also dangerous losses of elusive vitamins has indeed been a gigantic problem of unprecedented importance. The whole nation — army organizations and civilian organizations — has devoted much thought to those problems with a good measure of success.

In relation to feeding and caring for animals such titles as Protein Requirements of Chicks, Dry Rations for Raising Calves and Chore Efficiency name examples of attempts to find substitutes in the case of certain feed shortages or to use machienry and human labor in ways to increase efficiency and reduce the demand for increasingly scarce help.

Entomology assists in the war effort by trying to protect from insects the same food products during processing and shipment. It also assists investigating and perfecting an innumerable number of new insecticides for the better control and eradication of insects which are an ever-present menace to production at home and definitely related to the incidence of disease in countries abroad.

These are but examples of research activities this past year that are specifically related to the war effort. The reader will sense other investigations with equally important relationships. Any description here is purposely concise, and lacking in detail. Many problems that can be expressed in simple terms may involve intricate procedures, infinite patience, painstaking care, and a great many techniques pre-supporting mechanics and imagination.

Science continually evolves new mechanical equipment. War usually accelerates the perfecting of such machines; the research organization

that does not include mathematicians and mechanically-minded scientists, along with chemists and boilogists, may waste inexcusable time in using antiquated time-consuming methods in the search for new knowledge. Two or three examples of the uses of mechanical equipment might be taken from recent practices in our own station work.

Of course the slide rule and the mechanical adding machine are not new. Industries have used the adding machine, and practicing engineers have carried rules for some considerable time. However, the first slide rule was assembled no longer ago than 1850 and so-called adding machines are being systematically improved and perfected to accomplish other results than addition even down to the beginning of this war. In this director's undergraduate days such equipment was conspiciously absent from the Agricultural College offices and laboratories. With the comparatively recent emphasis on statistical methods, even for developing experimental plots and arrangements, together with innumerable figures that become available to condition results when added, divided and otherwise manipulated, a majority of our own departments now own, or have access to, one or more mathematical computing machines. Such machines of the present day not only operate with electric motors but also multiply and divide automatically, as well as add when complicated figures are properly introduced and the machines are set in motion.

The "Electric Eye" and the photo-electric cell are now used for chemical analyses to judge certain combinations visually and much more accurately than is possible through tedious and painstaking manual manipulation of chemical reagents. Such equipment is represented in our Agricultural and Biological Chemistry Department by a Klett-Summerson Photoelectric Colorimeter and Fluorimeter and a Beckman Spectrophotometer.

As an undergraduate your director's meager comprehension of chemistry revolved around the concept that an atom was the "smallest conceivable division of matter." In recent years, that concept has been greatly modified to encompass the comprehension of atoms themselves as being subdivided or "smashed" like so many glass marbles. Specifically, the significant part of "atom smashing" is that the nucleus of an atom is made up of many parts, again infinitely smaller than the atom itself and it is this part that gets its protons and neutrons disrupted and the electric equilibrum upset with electrons at the perifery of the atom. The atom as a whole then becomes unstable. This accounts for radioactivity, discovered no longer ago than 1896. Radioactivated phosphorus, for example, can now be used experimentally and practically as fertilizer. Due to its activation, it can be detected in leaves, stems, or wherever in the plant it travels. This may be a fundamental problem on occasion in fertilization. The process of sensitizing or activating chemical elements requires very expensive equipment, but detecting the presence of materials once they are activated can be done with a small hand instrument. Co-operating with the Massachusetts Institute of Technology we have been able to get some activated material for experimental use made in their own "cyclotron" together with considerable sympathetic help and direction in its fundamental use biologically in our agricultural research.

We now have an instrument bought in co-operation with our Biological Institute for detecting the migration of such material in plants and soils for months and even years following its application.

We are all made aware of the phenomenal strides that are brought about through inventions to win wars, and recognize the fact that such discoveries usually have their counterparts in postwar applications to civilian welfare. In agricultural research we usually get a new inspirational insight into everyday problems of health maintenance through systematic medical examinations of a vast cross-section of our best American youth. The present times are no exception. The need is emphasized not only for sufficient food but also for adequate diets contributing to a variety intake commensurate with the requirements of a complicated body mechanism. So far we neither have all the answers concerning trace elements that may insure sound teeth, for example, nor have we more than scratched the surface regarding the influence of vitamins on bodily organs with such a subtile response as eyesight In all our station experimental work, then, there is no waste in the sense of temporary diversions of energy to war problems; there may be some change in emphasis, to be sure, but all who work seek solutions that are for perpetuity.

No better evidence of the success of our country's system of state agricultural experiment stations is needed than the leadership of America in the world's agricultural economy; our farmers' contribution to the success of the allied armies in a world at war; our nation's current increased production of food in spite of unavoidable wartime handicaps resulting from curtailed farm equipment and a serious manpower shortage. New Hampshire's Agricultural Experiment Station is aware of its responsibilities and its corps of well-trained, energetic, hard-working personnel is contributing to its prestige, even in wartime.

NEW EQUIPMENT

DEPARTMENT	DESCRIPTION OF EQUIPMENT
Agricultural Chemistry	Colorimeter, Photoelectric, Klett-Summerson, Glass Cell Model, #3790A
Agricultural Economics	Decimal timers (Knee action & shock absorbing) 7 jewels, nickel chrome cases
Agronomy	1 Base Cabinet #264 (seed testing)
Bacteriology	Milk Sample Cases Analytical Balance, #1519, Z1
Botany	2 Hygrographs, #580 complete with charts, ink and instruction book Thermostat, Fenwal & Relay (A. C. Leach)
Dairy	1 Balance, 3-beam
Entomology	1 Crank Duster Hydrometer (replacing automatic control in research greenhouse)

NEW EQUIPMENT (Cont.)

DEPARTMENT	DESCRIPTION OF EQUIPMENT
Entomology (Cont.)	1 Automatic Pipette, Fisher volustat 1 Volustat Foot Switch 1 Measuring Chamber 1 Colloid Mill #5110 5 dozen Corner Irons 997-4″ 1 Bean gun with cutoff and coupling Instant Diffuser, Model #7 (Furemal) 1 Air conditioning spray nozzle 1 Bantam SH Mikro-Pulverizer, #7220 Meter, Gamma pH, std. Model 1, #2000 Refractometer, Spencer, #10075 Cold Rolled ½ din rod, 8′ 2′ ½ din brass rod 6″ 1″ brass hexagon bar
Horticulture	1 Recorder - Spec. Model S, 40358 FM553
Poultry	1 Concrete Mixer, H & Z Model, with electric motor Indicator Assembly - #7662 A1, Serial 545564-A

CHANGES IN PERSONNEL

As an illustration of the difficulties of personnel maintenance in these trying times and for the sake of record, the following tabulation of changes is given:

Losses from Station Staff during The Fiscal Year July, 1944 to June, 1945

Barratt, Raymond W.—Research Assistant in Botany and Horticulture. Resigned July 10, 1944, to take a university job elsewhere.

Barratt, Helen R.—Research Assistant Botany. Resigned August 19, 1944, to join her husband.

Buck, Charles B.—Poultry Inspection. Resigned April 30, 1945, to continue farming on his own farm.

Campbell, E. Prescott—Purchasing Assistant, Business Office. Resigned October 31, 1944, to go into the hardware business for himself.

Farber, Sally (Mrs.)—Stenographer. Left November 20, 1944, to help her husband in local shoe store.

Glover, Leon C. (Dr.)—Research Assistant in Entomology. Resigned January 31, 1945, to take a position with a commercial oil company.

Gordon, Lurlene A. (Miss)—Library Assistant in charge of Plant and Animal Sciences Library. Granted leave September 9, 1944, to do graduate work and resigned March 31, 1945. She later accepted a position with the Chicago Quartermaster Depot.

Harriman, Helen—Stenographer. Resigned June 30, 1945.

Henry, Phoebe W. (Mrs.)—Laboratory Technician in Bacteriology. Resigned June 2, 1945, because of ill health.

Latimer, Helen H. (Mrs.)—Assistant and Gas Analyst in Animal Husbandry. Resigned June 30, 1945, for business trip to California.
Levcowich, Tatiana—Research Assistant in Home Economics. Resigned June 30, 1945, to give full time to teaching in same department.
McFadden, Elizabeth E.—Clerk in Director's Office. Resigned November 15, 1944, in anticipation of marriage and housekeeping.
Nichols, Arlene A.—Assistant Laboratory Technician in Poultry. Resigned June 16, 1945, to study at a hospital.
Sicilian, Theresa—Graduate Assistant in Bacteriology. Finished June 30, 1945, with M.S. degree.
Stickney, Margery—Stenographer in Agricultural Economics. Resigned September 30, 1944, to assist in emergency at home.
Waller, Ernest F. (Dr.)—Poultry Pathologist. Resigned April 15, 1945, to accept Headship of Veterinary Department at another institution.

Additions to Station Staff during The Fiscal Year

Bardwell, Edwin T.—Record of Performance Supervisor, Poultry Department, October 15, 1944.
Bauer, George N. (Dr.)—Assistant in Agricultural Statistics. September 1, 1944. Temporary.
Burpee, Maisie C.—Clerk in Director's office. November 8, 1944.
French, Jean—Laboratory Technician in Bacteriology. June 18, 1945. Temporary.
Fullington, Mildred A.—Stenographer, Horticultural Department. July 24, 1944.
Harwood, Wilfred T.—Library Assistant in charge Plant and Animal Sciences Library. October 23, 1944.
Horne, Grace I.—Stenographer Poultry Husbandry, July 1, 1944.
Jones, Richard C. (Dr.)—Research Assistant in Botany. October 23, 1944. Temporary.
Littlefield, Willis E.—Purchasing Assistant, Business Office. October 30, 1944.
Loughlin, Margaret E.—Assistant in Agricultural and Biological Chemistry. October 1, 1944. Temporary.
McNeill, Mary V.—Stenographer in Agronomy. July 1, 1944.
Smith, William W. (Dr.)—Research Assistant in Horticulture. Re-instated from Military Service July 1, 1944. Temporarily released for work with U.S.D.A. August 1, 1944, to February 1, 1945.

PUBLICATIONS

Bulletins

352 Inspection of Commercial Feedingstuffs for 1944
353 Inspection of Commercial Fertilizers for 1944
354 Agricultural Research in New Hampshire

Circulars

68 Cobalt Treatment of a Nutritional Disease in New Hampshire Dairy Cattle. A preliminary report.
69 The Effect of Temperature, Soil Reaction, and Soil Nutrients on the Growth of Gerbera in the Greenhouse

Technical Bulletins

82 Altenaria Blight versus the Genus Lycopersicon
83 Sensitive-Fern Poisoning of Horses
84 Characteristics of Staphylococci and Staphylococcal Toxins
85 Blue-Comb Disease
86 Analysis of Certain Factors Involved in Dairy Herd Management in New Hampshire
87 Influences of Vitamin A on the Utilization of Energy and Protein by Calves

Scientific Contributions

94 Sawdust, Seaweed and Meadow Hay as Mulch for McIntosh Apples - American Society for Horticultural Science - Vol. 44, 1944
95 A Comparison of the Effect of Colchicine Applications on Plants and Seeds - American Society for Horticultural Science - Vol. 45, 1944
96 On the Determination of Esterified Cholesterol - The Journal of Biological Chemistry - Vol. 156, No. 1, Nov. 1944
97 The Possibility of Producing Forcing Stocks of Lily-of-the-Valley in New Hampshire - American Society for Horticultural Science - Vol. 45, 1944
98 How to Grow the African Violet - Flower Grower, 2049 Grand Central Terminal, New York, N. Y.

AGRICULTURAL ECONOMICS

An Inventory of Land Improvements Needed

Improved field practices and tractor equipment cannot be used to the best advantage where operations are handicapped by stone cross fences, large stones, ledge outcrop, or wet areas. In October, 1944, dairy farmers of Belmont were interviewed with reference to possible improvements of tillage land that might be made on their farms in the postwar period.

The 27 dairy operators reported a total of 1369 acres of tillage land of which 1143 acres were classified by the operator as good crop land. The remaining 226 acres were called permanent hay land. According to the estimates by these farmers, there was a total of 1135 rocks, 19,005 linear feet of stonewall, 19 small areas of ledge, 22 old apple trees, several piles of small rocks, and numerous wet area which, at present, impede cultivation. Over 12,000 feet of ditches and tile would be required to drain these wet areas. The stonewalls and rocks on the fields totaled approximately 14,000 tons for the 27 farms.

About 40 per cent of the operators were interested in making some of the needed improvements, and three already had undertaken minor clearing projects. The survey indicates that many aggressive operators will want to make improvements in this crop land, especially if a plan can be developed to make special machinery available.

Major improvements needed in barns, water supply, and in the homes were also inventoried.

H. C. WOODWORTH

Every-Other-Day Delivery of Mik

Soon after Pearl Harbor, New Hampshire milk distributors changed over to an every-other-day delivery basis, in order to save tires and equipment. Toward the end of the war the dairy industry was considering the possibility of retaining this and other war-time gains. In order to get consumer reactions to the continuation of every-other-day delivery, records were taken from 129 consumers in Dover. Of the number 80 per cent indicated no particular trouble in refrigerating two days' supply; 20 per cent had experienced minor difficulty; 68 per cent had not noticed any quality problem in holding milk over the second day; and only 3 per cent had experienced definite quality problems.

To the question: "Will every-other-day delivery of milk be acceptable to you after the war?" 26 per cent indicated a willingness to continue; 44 per cent said "no"; and 30 per cent were indifferent. However, of the 57 who reacted negatively, 13 indicated a willingness to continue; and eight were indifferent to the fact that the savings due to the new practice were shared with them. This leaves 36 consumers, or 29 per cent, who indicated they would prefer every-day delivery of milk after the war even if the cost was slightly higher.

The data indicate that the consumer has adjusted to every-other-day delivery of milk, that the system has been, in the main, satisfactory, and that consumers, at present, tend to be indifferent and have no strong antagonism for or against continuing.

H. C. Woodworth, J. C. Holmes

The Operation of the Colebrook Plan

The Colebrook Plan for the reorganization of milk trucking in northern Coos county was put into effect on August 15, 1942, by the O.D.T.

A complete inventory and location of producers was made as of July 15, 1944, which was comparable to similar data previously made up for April 30, 1942. In the lapse of 14½ months there were 96 changes in personnel, ownership, or location from the original 314 producers. The milkshed had expanded to new areas and the total volume of milk, especially in the pasture flush period, had expanded. The data obtained indicated that the plan had been of considerable help in transporting milk in this emergency period. The occasional difficulties encountered in getting milk to the plant on time were due to delays in milking on farms where labor was short, to truck and tire deterioration and occasional breakdown, to inadequate facilities at the plant, and, in a few instances, to attitude or friction between truckers and producers. The conditions would have been very difficult if a plan had not been functioning because with fewer trucks and fewer self haulers the larger supplies of milk were unloaded at the plant with less confusion than under the former system.

H. C. Woodworth, J. C. Holmes

Purchasing Fertilizers in New Hampshire

Commercial fertilizers constitute one of the most important productive goods purchased by New Hampshire farmers. More attention may well be given to such purchases in order to obtain products more suitable for specific uses and to receive best values for the money spent.

1. **Source of product.** The magnitude of the farm fertilizer expense justifies an investigation of the sources of purchases within the community.

2. **Reliability of product.** Guarantees may be checked against inspection reports available at the Agricultural Experiment Statiin or State Department of Agriculture. In the inspection reports of various companies studied the amounts of chemicals found ranged on the average from slightly below to 9 per cent over the guarantees.

3. **Price quotations.** Considerable variations in prices are found for some analyses. Average maximum savings (difference between lowest and highest quotations) for a five-year period on seven different popular analyses ranged from about $1.00 to $8.00 per ton.

4. **Early ordering.** Consider available storage on farm and determine whether early ordering and acceptance of delivery will mean a net saving. Some companies offer more attractive prices on early orders. One company offered savings of $1.60 per ton.

5. **Economy in selected analyses.** High analysis products average much lower in cost per unit of chemicals than do low analysis products. In 13 cases studied, the chemicals in low analysis products averaged 23 per cent higher in price than in high analysis products.

6. **Mixtures vs. chemicals.** Chemicals cost less when purchased separately than in mixtures. From about $5.00 to $17.00 a ton less in instances where the ingredients were purchased separately and were home-mixed.

7. **Size of order.** Discounts have commonly been made at the four-bag, ton, 10-ton, and at carlot or higher levels. Savings on volume orders may range from about $1.00 to $4.50 per ton, depending on the amounts purchased. This may involve co-operative orders or close co-operation with a specific company.

8. **Delivery direct from plant.** Size of order, time of ordering, and location of farmer and fertilizer plant are all factors which enter into arrangements for direct delivery from plants. Deliveries can often be arranged at no extra charge, particularly in full truck loads.

9. **Car-door delivery.** Car-door delivery is a possible means of cutting costs. It may not be practicable for those not having trucks but, in some cases, acceptance of delivery direct from car may make possible a lower price than when rehandled from warehouse floor.

10. **Credit.** Where credit is essential in fertilizer purchases, bank credit will result in considerable saving over purchases which follow the regular time-price schedules. Savings of from one to three dollars a ton appear as reasonable possibilities.

L. A. DOUGHERTY

Developing Home and Market Outlets

Determination of opportunities to more fully utilize and develop local markets for perishables is the objective of this study. Particular attention is being given improved common, cold, and freezer storage as means of making perishables available over a longer season. Demand for such products as strawberries, raspberries, and blueberries will increase enormously when it becomes possible to consume them fresh from lockers or boxes every day in the year. Many holders of freezer storage will wish to buy additional garden-fresh produce to freeze. Furthermore, the locker plants are interested in freezing additional products.

The amounts and kinds of products being frozen at several plants are being analyzed. At the present time, although meat makes up a large percentage of the whole, increasing interest is shown in fruits and vegetables. These are products which individuals can fully process.

The products processed by two freezer locker plants, in 1944, were approximately as follows:

	Meats	Poultry	Vegetables	Fruits
Plant 1	87%	6%	5%	2%
Plant 2	88%	7%	3%	2%

In Plant 2, raspberries, peaches and blueberries were, in order, the most important fruits and made up about 80 per cent of all fruits. Peas, corn, and beans were, in order, the most important vegetables and constituted over 80 per cent of all vegetables. Pork made up 56 per cent and beef 30 per cent of all meats and poultry. One-third of all products were processed in November and December and only 5 per cent in August and September. Expansion in freezing of fruits and vegetables will increase the relative amounts processed during these two months.

Few freezer plants have been able to get needed labor-saving devices for processing fruits and vegetables, and few suitable machines are available. At present, either home or plant processing of such fine products as peas results in a product costing all out of proportion to the commercially frozen product. For example, a $375 pea huller with one operator can do about as much work as 40 women. Introduction of labor-saving devices will go a long way toward making freezer locker plants indispensable assets to the community.

L. A. DOUGHERTY

Income Formulas

It was proposed to develop certain Index of Income formulas for specialized farms, such as dairy, poultry, and fruit. During the year, the emphasis was placed on dairy farms. It is believed that the general principles underlying an index formula for dairy farms would apply, with appropriate modifications, to any other type of specialized farm.

The dairy herds, listed according to counties, were checked with the County Agricultural Agents. A random sample was then taken by the use of random numbers. This method gives every dairy farm in New Hampshire an equal chance with every other dairy farm to be included in the sample. This sample should be representative of the dairy industry of the state as a whole.

In the study of dairy farms it is proposed to develop a formula that will reveal changes of income from year to year without canvassing the farmers annually. The formula is to be of such a nature that published figures of prices and quantities can be used to compute farm incomes after basic figures for some one year have been secured. The year 1944 was selected as the year of reference.

A preliminary survey made early in the year revealed two outstanding facts. 1. It was found, as a rule, that 90 per cent to 95 per cent of the total cash incomes comes from the sale of milk and the sale of cows and calves. 2. It was found that the items of expense of outstanding importance are feed and labor. In view of these facts, chief attention was devoted to the income from milk and cows and calves and to the cost of feed and labor. Series were computed, showing income per cow, per year, and the cost of grain per cow, per year. The question of labor costs was more complicated.

It was found that there is a very close correlation between the cost of grain per cow, per year, and the value of milk per cow, per year. The ratio of the cost of grain to the value of milk over a period of 15 years varied from .23 to .27. It was also found that if there had been no milk subsidy, the farmers would have been operating in 1944 at a more disadvantageous ratio than at any time during the 14-year period.

In developing the formula for the Index of Income of dairy farms, series of relatives were computed for each of the major items of income and expense.

The work is still in progress and the final formula has not yet been achieved; but preliminary figures show a rather substantial increase in income from year to year, during recent years.

G. N. BAUER

CHEMISTRY

The Carbohydrates of Pasture and Hay Crops As Related to Their Utilization by Cattle

Twenty-three samples (13 grasses and 10 legumes) have been obtained to meet the stringent requirements of this project. Of these one is from the University of California, two from Pennsylvania State College, four from the University of Illinois, and 16 from the University of New Hampshire. Portions of these samples have been prepared for analysis. Their extraction with ether is completed.

T. G. PHILLIPS, T. O. SMITH

Study of Thiamine Assay Methods

Current activity is concerned mainly with determining a means for eliminating the error due to non-thiochrome materials, which is often encountered in the fluorimetric assay of thiamine. This study is based on the fact that the presence of benzenesulfonyl chloride blocks the conversion of thiamine to thiochrome. Thus, in carrying out an assay, two samples are subjected to oxidation by alkaline potassium ferricyanide, to one of which benzenesulfonyl chloride is added prior to addition of the

oxidizing material. This latter sample acts as a blank solution, and any flourescence value found is subtracted from that of the other sample in order to arrive at the true thiamine content of the substance being analyzed.

Thus, current investigational work is concerned with pure solutions of thiamine and with similar solutions to which have been added certain of the other water-soluble vitamins. This fundamental approach was deemed necessary in order to ascertain the effect of the blocking agent used. The results indicate that this procedure is indeed satisfactory for the assay of such pure solutions. Since different fluorescent readings were obtained when different lots of stock solutions were used, however, it appears to be a necessity that standard thiamine solutions are employed for purposes of calibration each time unknown solutions are assayed for thiamine.

Since the procedure being studied appears satisfactory for pure vitamin solutions, it is intended next to examine its applicability to various foods and biological fluids.

Factors Affecting the Nutritive Value of New Hampshire-Grown Fruits and Vegetables

(Also a Home Economic Project)

The Effects of Quick-Freezing on the Vitamin Content of Strawberries

In 1943, it was noted that the Catskill variety of berries, while not containing the highest amount of ascorbic acid of the several varieties studied, retained the largest amount of ascorbic acid after freezing and storage. Hence, this was the variety chosen for further study.

Field samples were taken for immediate analysis at the time of picking, and the remainder were stored until such time as they would normally reach retail trade. At this time a sampling was made of the entire lot for immediate analysis, and other samples were removed to study the effect of holding at room and refrigerator temperatures, thus simulating the actual practice in retail stores. Aliquots were analyzed after 12- and 24-hour periods. The remainder were prepared for preservation by washing and hulling, an aliquot being removed for analysis at this step. Three methods of preservation by freezing were used: (1) in 50 per cent sugar syrup, (2)whole dry pack, and (3) blanched prior to freezing whole dry pack. An aliquot of the blanched berries, and aliquots of all frozen packs were analyzed after 12 hours of quick freezing and at ½, 3, 6, and 9 months of storage.

In 1944, the fresh Catskill sample contained 90.5 per cent moisture and 49 *mg.* ascorbic acid per 100 grams (fresh weight); whereas, in 1943, the Catskill samples, harvested at three different times, ranged from 88.6 per cent to 90 per cent moisture and 64 to 78 *mg.* ascorbic acid. There appeared to be no loss in ascorbic acid content from the time the berries were harvested (field sample) until they were washed and hulled preparatory to preserving. The only loss in samples held to simulate retail prac-

tices occurred in the 24-hour sample at room temperature. This loss was approximately 23 per cent on both the fresh and dryweight basis. In 1943, losses under similar conditions (for the several varieties studied) ranged from 21 to 57 per cent (dry weight basis) and included losses in two samplings of Catskills, 21 per cent and 39 per cent. Furthermore, in 1944, the moisture content showed no appreciable change during this holding period in contrast to wide variations noted over the same period during the previous year. No apparent loss of ascorbic acid was noted as a result of blanching.

All samples lost ascorbic acid as a result of freezing and storing. The blanched and unblanched lost approximately the same amount of ascorbic acid over a nine-month period, dropping to 30 *mg.* per 100 grams fresh weight. The time at which this loss occurred was not the same in all three cases. Those frozen with syrup showed their greatest loss during the first three months, while with the blanched and unblanched it occurred during the three- to six-month interval. Immediately after freezing berries in 50 per cent sugar syrup and all during their frozen storage, the ascorbic acid values were considerably higher than the comparable whole berries. Hence, the presence of added sugar apparently gives erroneously high results for this vitamin.

Earlier results caused the statement to be made that "In a comparison between samples frozen or samples held at room temperature, the apparent percentage loss in four months of cold storage was practically the same as the loss in holding fresh berries for 24 hours at room temperature." In 1944, the 24-hour room storage gave a loss of approximately 23 per cent with a comparable loss resulting in whole frozen berries between the third and the sixth month of storage.

In palatability tests berries frozen in syrup were given a higher rating when tested as preserved, but when all types were blended with syrup there was no outstanding preference. Judges recommended a weaker syrup solution. All types were still desirable after nine months of storage.

The Effects of Freezing and Dehydration on the Carotene Content of Blue Hubbard and Butternut Squashes

The squash investigation during 1944-45 followed the same plan as that carried on during the previous year, wherein changes were noted in the carotene content due to different means of storing the Blue Hubbard and Butternut varieties. Twenty-five squashes of each variety were harvested, September 21, 1944. After a two-week period for "ripening," five Blue Hubbard and 12 Butternut were used in the freezing and dehydrating studies, and the remainder were left in cold storage.

The dehydrating and freezing methods were similar to those of last year with the exception that composite samples were sliced instead of the squashes being individually ground in a food chopper. Carotene determinations were run on composite samples at harvest, after "ripening," blanching, dehydrating, freezing, and storage periods: frozen and dehydrated — four to six months; cold storage — three and six months. In

previous work the Moore-Ely method was used, but in the present study analyses were made by the Zscheile method *(Journal of Biological Chemistry 144, 21-33, 1942)*.

Samples of the 1944 harvest contained approximately the same amount of carotene, 16.5 micrograms per gram fresh weight or 120 micrograms per gram of dry weight, and during the "ripening" there was very little change. After blanching, the samples gave higher carotene values in both cases. Still higher values for both varieties were noted immediately after freezing and progressively higher values were obtained after four to six months of storage, at which time both varieties showed approximately 50 micrograms per gram of fresh weight or 240 micrograms per gram of dry weight. These results do not compare with those of the previous year, when after "ripening," the Butternut squash contained a larger quantity of carotene than the Blue Hubbard; both samples lost during blanching, and, at the end of six months' frozen storage, the Butternut gave results 33 per cent lower than the blanched sample, while the Blue Hubbard was practically the same as its blanched sample. The dehydrated samples in both seasons are more comparable. Each time, although the dehydrated product (both varieties) contained a considerable quantity of carotene per gram, there was actually a great loss resulting from the dehydration process and the subsequent storage of the dried samples. In both cases, this year's loss amounted to practically 50 per cent, while, last year, the Butternut lost approximately 33 per cent and the Blue Hubbard 20 per cent of its value from the time of blanching.

During cold storage, there was an increase in the carotene values together with a decrease in the total weight of the squashes. (This is similar to last year's findings.) It may be that as the actual quantity of flesh decreases (during storage) the same quantity of carotene is concentrated into a smaller quantity of solids. In this study the Blue Hubbard values increased to 41 micrograms and the Butternut to 57 micrograms per gram.

Palatability tests showed the dehydrated product to be greatly inferior to products preserved by other means.

The Effects of Canning (Home and Commercial) and Quick-Freezing on the Vitamin Content of String Beans

Four and one-half bushels of Bountiful string beans, picked on August 8, 1944, were used to note changes in carotene, thiamin, and riboflavin values due to canning (both home and commercial), quick freezing, and subsequent storage of the preserved product. The work was supplemented by an examination of other factors, such as holding the beans until such time as they would reach retail trade under conditions similar to those actually used by a commercial grower, and noting the effect of washing, stringing, and cutting the beans preparatory to preserving.

In most cases, in order to note the effect due to a shifting of solids from the beans to the liquid medium, distilled water was used as the can-

ning medium. A few brine-packed samples were included because this is the more common type of pack.

Preserved products were analyzed after one-half, three, six, and nine months of storage.

The garden-fresh beans averaged approximately 88.7 per cent moisture, 100 micrograms thiamin, 160 micrograms riboflavin and 300 micrograms carotene per 100 grams of beans. No significant change was noted in holding the beans, simulating actual commercial practice until such time as they would reach retail trade. The same was true for washing, stringing and cutting, and blanching preparatory to home canning or freezing. The chilled sample (for freezing) showed a slight loss of thiamin.

Processing for home and commercial canning, while causing great reduction in thiamin values, did not alter the riboflavin and carotene content if both bean and liquor are considered. In home canning the thiamin value dropped to approximately 60 micrograms, which was divided evenly between bean and liquor. This was true for both distilled water and brine pack. In the commercially canned samples the value dropped to approximately 50 micrograms, slightly more being in the liquor than the bean solids. The freezing process caused no appreciable alteration in any of the three vitamins.

In storage, large riboflavin losses were noted in all three cases; home canning approximately 75 per cent, commercial canning approximately 55 per cent, and frozen approximately 88 per cent. While thiamin consistently showed progressive losses, the greatest loss occurred in the frozen, and the least in the commercially canned. Progressive losses in carotene were noted in frozen stored beans, amounting to approximately 60 per cent over the nine-month storage period. This was not noted in the other two cases, where the values remained practically the same or showed a slight increase.

Brine-packed beans showed no distinct differences in retention or losses.

In a study of the commercially canned beans, it was found that between one-fourth and one-fifth of the original bean solids had dissolved in the liquor (distilled water) during storage.

The sugars found in the solids of the liquor nearly equalled those remaining in the beans.

S. R. SHIMER, H. J. PURINGTON, A. E. TEERI, T. LEVCOWICH, A. F. YEAGER

CROPS

Rotation, Fertility, and Cultural Experiments With Potatoes in Northern New Hampshire

During the past three years an effort has been made to determine whether potatoes grown on a selected field would respond to calcium sulphate or gypsum. Results the first two years were quite convincing that either the calcium or the sulphur was of direct benefit to the potato crop.

Due to a very dry season in the Colebrook area in 1944, potato yields were very low and the results did not confirm those that had been obtained in 1942 and 1943, when increases of from 16 to 59 bushels per acre were recorded for varying amounts of gypsum.

The lack of response in 1944 is attributed to low rainfall and to the fact that water rather than plant food was the limiting factor.

These same weather conditions hampered other phases of the experiment, but the results of fertilizer placement studies follow those of previous years, regardless of the low yields. There is an advantage for banding over any other method of placement, whereas, according to these data, there is no advantage in banding one substance and broadcasting the others as compared with broadcasting all ingredients.

Because of the extreme drouth we are not presenting the 1944 yields of the fertilizer ratio test. The plots varied too much for any significance, and the positional difference of the various plots had a greater effect than any variation in treatment.

Tuber samples were taken from the different fertilizer treatments and also of the different varieties in the variety test; then the cooking quality was determined by the specific gravity method. Salt solutions of different specific gravity were used to float each portion of the sample and a weighted average of each sample recorded. It has been found that potatoes having a specific gravity of 1.055 to 1.070 are certain to be soggy, while from 1.075 to 1.080 they could be classed as fair. When the specific gravity is 1.085 or 1.090 the tubers are mealy enough to be classed good, while those above 1.095 are very mealy and are classed excellent.

Of the new varieties, Potomac and Mohawk were the only varieties that compare favorably with Green Mountain and Russet. The quality rating was reduced on plots receiving a high potash content in the fertilizer and was raised when the phosphorus was increased. This checks with all previous data. Variations due to fertilizer are slight. Plots treated with calcium sulphate as an amendment have a tendency to be of higher quality.

A topsoil, low in calcium, low in organic matter, and, because of the latter condition, low in readily mineralized sulphur, was placed in boxes built into a greenhouse bench. Each box contained 65 pounds of moist soil and was regarded as equivalent to 1/7260th of an acre with two seed pieces set approximately one foot apart. The seed pieces were cut from the bud end of Green Mountain tubers (at least 1½ ounces per piece) which had previously been green sprouted to permit elimination of weak sprouting buds, thereby minimizing the danger of having leaf roll plants present in the experimental population.

The fertilizer treatments were made equivalent in N, P and K to an application of one ton per acre of 6-12-12. All salts, except the gypsum and limestone, were C. P. chemicals. The various mixtures were applied in bands on either side of the seed pieces and approximately three inches below the surface of the soil.

The results indicated that the influence of both calcium and sulphur in the nutrition of the potato is reflected primarily in an increase in both

yield and set of tubers. However, there is an indication that calcium is slightly more involved in the set of tubers and sulphur slightly more involved in the yield.

Differences in quality of the potatoes were not striking and since the test involved only a relatively small number of tubers and a variable number of tubers for the various treatments it would be hazardous to rely upon any apparent differences. In general, the quality ranged from fair to good.

The results above indicate a danger inherent in the trend toward use of high analysis fertilizers which may be low in sulphur because of the absence of gypsum and the replacement of $(NH_4)_2SO_4$ by NH_4NO_3 and nitrogen solutions. Further greenhouse trials are contemplated and field trials are under way to shed further light on the problem.

Tests of 15 varieties of potatoes were conducted in two locations, one in Colebrook and one in Madbury. In the dry season the Russet variety, one not commonly grown in New Hampshire, had the highest yield in both tests. Pawnee, a new variety, showed up well. This variety had not shown much promise during the two previous seasons. Katahdin also showed up well.

Of the very new varieties Mohawk had a fairly good yield and distinctly better quality than other newer strains. Potomac also yielded well but appeared to be susceptible to blight. A test of 17 varieties is under way this season in Madbury. A few unpromising ones have been dropped but several new ones have been added.

P. T. BLOOD, F. S. PRINCE, L. T. KARDOS

Proper Construction of Farm and Commercial Potato Storages

During the past storage season, this study was directed toward getting information on the influence of various gaseous conditions (chiefly CO_2) upon the sprouting and quality of potatoes when held at normal late season storage temperatures, 45° - 55°F. The test was started April 11, 1945, upon potatoes that had been held since harvest under good storage conditions, but at a time when they were just beginning to break dormancy.

Approximately 100 pounds of Green Mountain potatoes 1½" - 1¾" in size were placed in each of four air-tight wooden barrels. The tubers selected were free from injuries and rot. Each barrel was fitted with an observation window, a thermocouple for ascertaining internal temperatures, and apertures for injecting or sampling gases.

Photographs and observations show that potatoes remained dormant for 39 days in the containers in which a 10 per cent content of CO_2 was maintained. The temperature range during this period was from 49°F - 52°F. After 69 days, there was some sprouting of tubers in the containers with a high CO_2 content but sprouting was much greater in the aerated containers.

If this method could be applied commercially to hold potatoes dormant, "old" potatoes could compete more favorably on the late spring market with new potatoes from the south. Labor of sprouting and con-

siderable storage losses would also be eliminated. If certified seed growers could ship seed potatoes that had been kept from sprouting by some method such as this it would save them money and they would have better seed for the market.

P. T. Blood, L. T. Kardos

A Dairy Farm Rotation in Southern New Hampshire With Sweet Corn as a Cash Crop

In this experiment, located on the C. T. Lane farm in Chichester, sweet corn was again grown in 1944 with different fertilizer — a side dressing treatment of 260 pounds of nitrate of soda per acre, and manure.

Erban and Vanguard oats were used as a nurse crop for seeding down to two new strains of timothy which were developed in the plant-breeding program. Oats and timothy will both be harvested for seed. Seed of the late hay strain was harvested in 1944 from the seeding made in 1943.

In 1944, sweet corn yields were somewhat lower than in previous years due to an adverse growing season. Side dressing was performed just at the beginning of a period of heat and drought, and at the time of second cultivation. As in previous years, dry weather immediately following a side dressing has tended to nullify the effects of this practice.

The basic treatment was applied with a fertilizer attachment on the planter at planting time. The side dressing of 260 pounds of nitrate of soda per acre was put on with a two-row cultivator which had fertilizer attachments. The date of side dressing coincided with the second cultivation, July 14.

So far as the data are concerned they show no advantage, certainly for side dressing, and probably no difference for the fertilizer grades used as variables.

On other sections of the field sweet corn was grown with manure as a variable and also with fertilizer or side dressing variations. The average yield of all plots receiving 30 tons of manure was 4.46 tons per acre while the yield of the 15 ton pots was 3.83 tons, a difference of .63 ton of sweet-corn ears for the added 15 tons of manure. This is a larger difference than has been reported in previous years, probably because of the effect of the larger manure application in increasing the organic and water content of the soil.

An attempt was made, in 1944, to determine which element, N, P_2O_5 or K_2O is responsible for increasing yields when suitable carriers are applied as side dressings. The resulting data are not convincing in any respect, probably due to the adverse weather encountered after the side dressing operation.

F. S. Prince, P. T. Blood

The Relation of Potash Levels to the Persistence of Clover in Hay Stands

This project is located on a terrace of the Connecticut River. Plots 1 - 46 on this field were top-dressed again in 1944 and harvested accord-

ing to plan. The top-dressing scheme involves variations in the level of potash with uniform nitrogen and phosphoric acid. One harvest only was secured in 1944. The stand of clover on this field was not maintained and there was very little clover in evidence in 1944. This was likely due to severe winterkilling in the later winter of 1943-44.

It is noteworthy that 100 pounds of muriate of potash is as effective as 10 tons manure in increasing yields and that 200 pounds equal the effect of 20 tons. Three hundred pounds of potash gave no increase over the 200-pound application. The results for using small amounts of boron are encouraging and the study of the value of this substance in hay production should be continued.

On another section of this field, plots 47 to 80, hay yields are being studied under a system of annual top-dressing. The seeding was made in 1937, and hay has been harvested each year since. Yields varied from 1,900 to 6,600 pounds per acre in 1944.

The data offer evidence as to how hay yields can be maintained at a relatively high level over a period of years. As has been explained in previous reports some of the series of plots have been top-dressed annually since 1937 at the same rate and without interruption. In the spring of 1942, treatments on certain other series were modified and since that time have been treated each spring with fertilizers equivalent to certain of the other treatments. Therefore, there are now three pairs of identical treatments since 1942.

For example, K (old) and K each received 125 pounds of muriate of potash per acre annually. Prior to 1942, the plots designated K had received no potash. On the basis of the three-year average the K plots have yielded 736 pounds less hay than the K (old) plots.

The same differences apply to the PK and 0-20-20 plots since the treatment beginning in 1942 has been identical, but the PK plots, which had a longer background of receiving super and potash, yielded as an average 1,887 pounds more hay than the 0-20-20.

A similar comparison may be made between the NPK treatment which has been applied since 1937 and the 8-16-16 which has been in operation only since 1942. The NPK yield averages 2040 pounds higher. The inference from these three comparisons is obvious, to keep hay yields at a high level an annual top-dressing system should be practiced.

The efficacy of potash in favorably influencing yields is shown by the difference between K (old) and the check or untreated plots, a difference of 1165 pounds. Another comparison is obtained between the 8-16-16 + K series and the 8-16-16 plots in which there is a difference of 971 pounds. This difference was more striking in 1944 than in previous year, 1944 yields showing a 2034-pound greater yield on the complete fertilizer with extra potash as against complete fertilizer alone.

F. S. PRINCE, P. T. BLOOD, G. P. PERCIVAL

Experiments with Small Grains in Northern New Hampshire

This experiment was undertaken to determine the highest yielding varieties of small grains for Northern New Hampshire, where the cli-

mate limits grain growing to small grains. Of these, oats are the most popular and appear to be best adapted.

With the exception of loose smut, oat diseases do not seem to be a serious hindrance. Hence, a wide selection of varieties is possible, if treated for this disease. It is important, therefore, to determine the varieties that have the ability to produce high yields in this climate.

In general, the Canadian varieties have stood up very well in our tests. In 1944, Ajax stood highest among all the varieties tested, yielding nine bushels more than New Victory which was second. Upright was third, Vicland fourth and Vanguard fifth. There were only five bushels per acre of difference between second and fifth place. Farmers in the area prefer a high-yielding, tall-strawed variety, so they can shift from grain to forage if need be. For this reason short-strawed oats like Vicland have not achieved too much popularity so far in spite of their disease resistance.

As a result of these tests two farmers are attempting to produce seed oats this year, one Ajax, the other Vanguard.

The test is being continued with 15 oat and two barley varieties in 1945.

P. T. BLOOD, F. S. PRINCE

Variety Trials with Oats and other Small Grains

Oats. Thirty varieties and strains of oats were planted at the Bunker Farm on May 10, 1944. Each variety was replicated three times in randomized rod rows spaced two feet apart. Twenty-five of these varieties were furnished by the United States Department of Agriculture and, therefore, were similar to the uniform trials in the other Northeastern states. Five local varieties were added because they had shown some promise in the past. A large number of the varieties were of the new disease-resistant sort, some of which, have not been named. Varieties used as checks were Gopher, Erban, Victory and Lenroc which have been commonly grown in New Hampshire. All "checks," except Erban, show no disease-resistance but generally are good grain yielders.

The oats were cut by hand from August 7 to August 14 as they ripened. Each row was weighed separately to get the forage yield and then the grain was threshed out by use of a "header." The grain from each row was bagged, dried, and later cleaned in the laboratory.

The 1944 oat yields did not show the differences in yield that were so evident for the 1943 season. This was because 1944, in contrast to 1943, was not an "oat disease" year. In 1944, the non-disease resistant varieties yielded just as well as did the new disease-resistant varieties.

In 1943, the average yield per acre was 52.4 bushels of grain when disease was prevalent; whereas, in 1944, the average yield was 66.21 bushels with no disease but with much less seasonal rainfall. Disease-resistant oats offer better assurance of good yields over a period of years since no one can determine in advance an oat-disease year. It is well to point out that the forage yield data are not too reliable for 1944. There was some variation in the degree of maturity when the different rod rows

were harvested. At least the results do give an indication of forage yield. Vicland continued to give excellent yields of heavy grain although it is not an extra high forage-yielding variety. The Canadian varieties, Vanguard, Erban, Ajax, and Beaver, partly resistant to stem rust, gave good yields both in forage and grain.

Barley. Fourteen barley varieties were grown along with the oat varieties. These were grown in duplicate and were planted, harvested, and yield calculations made at the same time as the oat samples. Included in the trials were some of the newer varieties. Wisconsin Barbless (Wisc # 38), Alpha, and Velvet, commonly grown in New Hampshire, were used as "checks."

No record was taken on the forage yield as it was quite broken down at harvest time. Two Canadian varieties, Byng and O.A.C. 21, showed promising yields and well-matured grain.

Spring Wheat. Twenty-three varieties of spring wheat were planted in single rod rows for observation. The wheat was handled just as were the oats and barley. Some of the rows looked so well at harvest time that grain was finally threshed and cleaned.

L. J. HIGGINS

Silage and Field Corn Trials

In this experiment varieties for check plots were selected on the basis of adaptability, maturing characteristics, and yields under New Hampshire conditions. During each season all varieties were replicated at least three times and all promising varieties were grown for at least three seasons. The 1944 season was actually the first in which several new hybrids were tried out with the selected "checks." During the preceding years, many varieties and hybrids have been discarded, due to inferior yielding ability and for other reasons.

Silage Corn. Twenty-four varieties and hybrids, making up the corn silage trials, were planted on May 17, 1944, at the Bunker Farm. Each variety was replicated three times in 18 hill rows with each hill thinned to three plants. West Branch Sweepstakes, a very popular and high silage-yielding, open-pollinated variety, and Cornell 29-3, a good yielding dent hybrid, were used as "checks."

On September 8, the corn silage was harvested. Twelve hills of each replication were weighed to get the green weight yield. One hill of three stalks of each replication was bagged and dried to obtain a uniform basis for calculating the dry matter yield per acre.

In general, due to the fact that the 1944 season's rainfall was below normal, there was not the usual spread in yields, and the earlier maturing varieties yielded proportionately better than the later maturing varieties. Ohio K-25 and DeKalb 628-a, two new hybrids, gave good yields in all replications.

Over a period of years there has been considerable fluctuation in silage yields, but West Branch Sweepstakes and Cornell 29-3 have been the more consistent yielders of mature late and early silage, respectively.

Grain or Field Corn. Forty varieties and hybrids were planted in three replications each, on May 17, 1944, at the Bunker Farm. Each replication was made up of 18 hills and each hill was thinned to three plants, thereby insuring uniformity. The proven "checks" included two unnamed local flint varieties: three dent-flint hybrids, Maine "A," Maine "B," and Wisconsin 240; and two open-pollinated dents, New Hampshire 500 and Cornell 11.

The ears were harvested on October 9 and 10, and each replication yield was weighed separately. Four ears were selected at random from each row to be dried down to a uniform moisture content and later to be used for the basis of calculating the moisture loss and yield per acre on a uniform moisture basis.

The 1944 grain yields were not up to the excellent yields of the 1943 season, due to a lack of rainfall. There was a tendency of less difference in yields; nevertheless, interesting differences appeared which decidedly favored the better adapted hybrids. Of the 40 varieties in the trials only the first 25 showed reasonable uniformity of yields in all replications.

In addition to the replicated corn silage and grain trial varieties, 15 new hybrids were grown for observation in single rows of 24 hills each. Half of each row was harvested for silage and the remaining hills for grain. Those that showed promise will be used in the 1945 corn trials.

L. J. HIGGINS

DAIRYING

Nutrition Studies with Dairy Cows

This project has as its broad objective a study of the nutritive value of pure stands of various grasses and legumes when used as pasturage for lactating dairy cows.

Specifically, it provides for a determination, by means of digestion and metabolism balances, of the digestible protein and of the metabolizable energy of successive cuttings of fresh clipped grass as a first step, and of the physiological utilization of these nutrients in the production of milk as a final objective.

Beginning with timothy, the first year's study has been completed. However, due to loss of critical personnel to War Services, it was done in a much modified form from the proposed project. The lactation phase had to be deferred and dry cows used instead. A second interference was imposed by the severe drought which limited the study to one cutting instead of two or more successive cuttings as planned. But this was partly offset by a cutting of hay from the same field of which a similar study was made. However, two digestion and metabolism experiments were carried out on the grass which was clipped daily from June 5 to 17, and two similar experiments were carried out on the hay which was cut on June 28 (after heading), and cured under favorable conditions.

The digestible protein was found to be 1.90 pounds and the total digestible nutrients 20 pounds per 100 pounds of fresh clipped grass. This

is materially less for protein and higher for total digestible nutrients than is indicated by published estimates *(F. B. Morrison, Feeds and Feeding, 20th Edition, pp. 953 and 972, 1936).*

A comparison of the digestible nutirents of the grass and of the hay cut about two weeks later shows a decrease of 13 per cent in digestibility of the protein and of 17 per cent in digestibility of the dry matter in the latter.

Determinations of the carotene content of the grass indicated that it remained constant at about 16 to 17 micrograms per gram of dry matter during the period of cutting. The carotene content of the hay has not been determined.

As this appears to represent the first instance in which the digestible nutrients of pure timothy at pasture stage has been experimentally determined, the result is of particular interest because of the wide divergence from published estimates. It also indicates the extraordinary neglected state of research and almost entire lack of specific physiological evidence on the nutritive value of one of our primary sources of food for livestock.

E. G. RITZMAN, N. F. COLOVOS*

The Effect of Vitamin D on the Metabolism and Utilization of Energy and Protein by Calves

This study was carried out on six male calves. Two of them were given an adequate amount of vitamin D (in form of irradiated yeast) and four were deprived of this vitamin supplement. All calves were kept in darkened stalls during the entire time of the experiment and, except for the vitamin differential, all received the same feed ration.

At the end of the vitamin-deficiency period, digestion balances and metabolism measurements were carried out on each calf to determine the degree to which deficiency of vitamin D affects the utilization of protein and energy in very young calves. Although the digestion balances and the metabolism measurements are completed, the extensive chemical determinations involved are still under way.

Visual effects of vitamin D deficiency were, however, very striking and of the usual rachitic type as regards effect on bone formation. The calf most severely affected developed constant intensive bloating during the final stage so that a trochar had to be used daily to release the gas. Post-mortem inspection showed the rumen to be almost entirely filled with semi-solid matter (i.e. moisture swollen beet pulp) which it was apparently unable to remove. This was apparently an accumulation of numerous days of feeding. Whether this was due to occlusion or to paralysis of the musculature of the rumen was not determined. However, none of the controls were so affected.

Although all calves were fed on the level of the lowest consumer there was a difference of 10 per cent in metabolism (i.e. total heat production) between the controls and deficients, the latter having the high-

*On Military leave.

er heat output. As this result was very clear-cut it will be necessary to carry out basal metabolism measurements under the same conditions to determine the effect of this vitamin on muscular metabolism.

The effect of vitamin deficiency on food utilization has been given but little study in the past. In our first series on this subject *(Tech. Bull. 87)* it was shown that digestion, absorption, and metabolizability of the energy were all depressed, and that protein utilization decreased an average of about 25 per cent due to a lack of vitamin A. This is particularly critical in growth of young calves during the first four or five months. No definite conclusion can be made as yet regarding the effect of vitamin D deficiency on food utilization but there was a definitely decreased growth rate on a similar feed intake. Total heat production measurements suggest that it may affect the basal metabolism materially.

H. A. Keener, N. F. Colovos*, E. G. Ritzman

Effect of Vitamin D Deficiency on Blood Constituents of Young Calves

During the entire time of the experiment, from December, 1944, to June, 1945, with the same calves reported on previously, blood samples were obtained weekly for determination of calcium phosphorous and phosphatase levels. These determinations showed striking changes in the phosphatase levels, suggesting a disturbance of normal phosphorous utilization. Furthermore, serum calcium also showed a marked decrease.

A. E. Teeri, H. A. Keener

Mineral Deficiencies in Livestock Nutrition

Since early in the spring of 1944, field and laboratory studies have been conducted on a nutritional deficiency in New Hampshire cattle, sheep, and goats, showing one or more of the following symptoms: depressed appetite, depraved appetite, constipation or diarrhea, rough hair coat, scaliness of skin, muscular incoordination, gauntness, loss of flesh, pale mucous membranes, decreased milk flow, retarded growth, and sometimes death. It has been found that this deficiency responds favorably to the feeding of cobalt.

Cobaltous sulphate has been furnished to treat animals on approximately 200 farms scattered for the most part throughout the southern half of New Hampshire. Cobaltous sulphate has also been furnished to several veterinarians and feed dealers who have also used it with very favorable results.

Responses as shown by recovery of normal appetites and increases in weight were usually observed in from three to five days, even when animals had been "off" feed for many months. General appearance usually returned to normal within a few weeks.

Information furnished by livestock men indicates that this condition has been prevalent for a great many years and that it is wide-spread throughout the state. Preliminary studies indicate that the bovine has a

*On Military leave.

very high tolerance for cobaltous sulphate fed orally. Certain blood constituents have been followed from deficiency through the return to normal. Field and greenhouse studies have also been carried out dealing with the plant response to the application of cobaltous sulphate to the soil.

H. A. KEENER, G. P. PERCIVAL, K. S. MORROW

Improving the Solids-not-fat Content Of Milk by Selective Breeding

Three more sires were proven, during the past year, making a total of 19; 11 Holstein, three Ayrshire, four Jersey, and one Guernsey.

Twelve sires increased and seven sires lowered milk production; 13 increased and six lowered fat percentage; 12 increased and seven lowered the percentage solids-not-fat. Nine sires increased both the fat and solids-not-fat percentage; three lowered both the fat and the solids-not-fat percentage; four increased the fat percentage and lowered the percentage solids-not-fat; three decreased the fat percentage and increased the solids-not-fat percentage.

Nine cow families, covering four or five generations, were also analyzed. The same type of relationship between the factors, milk production, fat percentage, and percentage solids-not-fat were observed with the cows as with their sires.

The results of the studies of sires and cow families emphasize the point that milk production, percentage butterfat, and percentage solids-not-fat are inherited separately.

H. C. MOORE, H. A. KEENER

Dry Rations for Raising Dairy Calves and Heifers

During the past year, the final group of eight calves, from the total of 20 calves started during the previous year, completed their experimental feeding period. These eight animals were paired as to breed, age, and sex for comparison between an all-vegetable-protein ration and a ration containing 20 per cent of skim milk powder. The values of the two types of rations were determined on the basis of growth and general appearance and by relative carotene, vitamin A, nicotinic acid, ascorbic acid, cholestrol, non-protein nitrogen, glucose, and phosphorus content of the blood.

As with the other animals on the comparative rations that were reported the previous year, the all-vegetable-protein dry calf ration produced results as good as those obtained with the standard type of ration containing a protein of animal source.

The major phases of this project as originally outlined have been completed. The results indicate that dry calf rations containing soybean oil meal as a major source of protein, and dried distillers' solubles, will give results equal to those secured from feeding the older-type dry calf ration containing cottonseed meal, linseed meal, and dried skim milk.

Normal growth curves are being prepared from growth data on 250 dairy calves raised in the University dairy herd during the past 11 years.

K. S. MORROW, H. A. KEENER, A. E. TEERI

Management Practices in University Herd

Work on this project to date has concerned itself with a study of the effect of certain herd management practices on milk production. The data pertaining to factors affecting breeding efficiency will be studied during the coming year.

In a comparison of the influence of the month of freshening on subsequent lactation milk yield (4 per cent F. C. M.), each of the four breeds, Ayrshire, Guernsey, Holstein, and Jersey, showed a marked increase for March and April calving as compared with February. In general, August appeared to be the poorest month for calving. There was no significant difference among breeds as to month of calving and its effect on milk production.

K. S. Morrow, H. A. Keener

Chore Efficiency

Detailed chore records were made on nine large dairy farms. This included over-all records on chores and detailed stop watch records on milking and other major practices.

When the data are plotted on charts, the large amount of time used in milking is outstanding. On these nine farms, a total of 3059 man minutes were used daily in milking 335 cows. This includes carrying milk to milk house but not care of equipment. In comparison, all feeding operations, including sweeping mangers, required 1111 man minutes. Manure disposal, cleaning gutters, and bedding required 1469 man minutes for the 335 cows milked and 70 dry cows. Of the total time used on these three major chores, 57 per cent was used in milking, 27 per cent in cleaning, and 16 per cent in feeding.

In milking the lowest time required was 4.8 man minutes daily per cow and the highest was 13.9. The study is continuing on the same farms and changes are underway to reduce time required.

H. C. Woodworth, K. S. Morrow, J. C. Holmes

Studies of Bovine Mastitis

Particular attention has been given to the chemotherapeutic value of penicillin for the treatment of mastitis. The penicillin, supplied through the courtesy of Lederle Laboratories, Pearl River, New York, was prepared so that each 100 *ml* contained 100,000 or 200,000 Oxford units. A 100 *ml* dose was injected into the infected quarter through the teat canal. Cows were given either one, two, or four injections immediately after milking. Cows given more than one injection were treated at 12-hour intervals.

Thirty-three cows and 59 quarters with streptococcal mastitis *(S. agalactiae)* were treated with penicillin, and 31 cows (93.9 per cent) and 55 quarters (93.2 per cent) were cured. Of the two cows not cured by the first treatment, one was cured after having been re-treated. Eight cows and 14 quarters with staphylococcal mastitis were treated with penicillin, and six cows (75 per cent) and 11 quarters (78.5 per cent)

were cured. The cases of streptococcal or staphylococcal mastitis not cured by the first administration of penicillin were those given one or two injections of 100,000 units of penicillin per 100 *ml.* dose. No mastitis streptococci or staphylococci could be detected in any of the cows considered cured when quarter samples were tested at weekly intervals over a period of four to five weeks after treatment. It was found that the organisms were eliminated from the udder when tested three to seven days after treatment, and that the leucocytes also disappeared even in cows showing leucocyte counts of 20,000,000 or more per *ml.* before treatment.

These results indicate that penicillin is highly effective for the treatment of bovine mastitis. Streptococcal mastitis may be cured by one injection of 100,000 Oxford units of penicillin administered in 100 *ml.* of sterile saline or distilled water through the teat canal. In more acute cases of long-standing, chronic infection, one or more injections containing 200,000 units may be necessary. Straphylococcal mastitis is more difficult to cure and may require one or more treatments with penicillin containing 200,000 Oxford units per 100 *ml.* dose.

These studies are being continued to determine the maximum dose of penicillin necessary for curing streptococcal and staphylococcal mastitis, the best method of administration and the value of penicillin for the treatment of acute cases.

In collaboration with Cerbiniol Laboratories of New York, the chemotherapeutic value of cerbiniol for mastitis was also studied. Approximately 50 cows with streptococcal mastitis and 11 cows with straphylococcal mastitis were injected intravenously with this drug. The results to date indicate that cerbiniol is not effective for the treatment of mastitis when injected in this manner.

L. W. SLANETZ, F. E. ALLEN, T. SICILIAN

FORESTRY

Study of Sugar Maples

Two small lots of seed, one from Sweet Sue (maple on the campus of the University of New Hampshire) and the other from a known sweet tree in Dublin were sowed in a seed-bed in the nursery on October 26, in order to test fall planting as a method of storing sugar maple seed. The seed germinated early and well, and the seedlings are now growing vigorously.

Nineteen grafts were made on small maples, 11 with cuttings from Sweet Sue, and eight from other maples. On May 29, only one graft looked as if it might succeed. The large pith present in the young twigs apparently was a complicating factor in making successful grafts.

Experimentation with indoor and outdoor beds for rooting cuttings was continued and some new phenoxy growth compounds were tested. The results are still unsatisfactory, as the percentage of cuttings which develop roots remains low. About 50 of the rooted cuttings were set in pots, placed in a coldframe, and mulched with straw over winter. They survived the winter, and 36 were set out on April 20, some in a maple

grove and the rest in grassland at the edge of the grove. For a time they appeared to be doing well; five developed green tips on the buds, but by May 29 all appeared to have died.

Location of Sweet Trees. Eleven samples of sap were tested for sweetness, four from Dover and seven from Madbury. Most of them were normal, with between 3 and 4 per cent sugar, but one contained 5.6 per cent which is considerably better than the average. As 1945 was not as "sweet" a year as 1944, further observations may show that this tree is really superior.

Sap-flow Studies. The short season of 1945 upset some of the plans for studying characteristics of sap flow. Random observations through the winter indicate that previous conclusions relative to the correlation between weather conditions and sap-flow are probably correct, although there are some instances for which there is no explanation.

Further investigation is necessary to determine changes in the rate of flow from hour to hour during the day. Records indicate that this is largely controlled by temperature, but the data are inadequate to substantiate this tentative conclusion.

Comparison of the total yield of an extra-sweet tree with that of one with sap of normal sweetness was attempted; while the results are not conclusive, they certainly point strongly to the superiority of the extra-sweet tree. Sweet Sue, in the last 19 days of the season (on only 11 of which sap ran in any quantity), produced decidedly more sap than did the normal tree, referred to as Plain Jane. The following table summarizes the results. (The syrup is standard grade, 11 pounds to the gallon.)

Yield of Sweet Tree Compared with that of Normal Tree

Tree	Sugar Content of Sap, %	Total Yield of Sap (gallons)	Total Yield of Syrup (gallons)	Sap (%)	Syrup (%)	Gallons of Sap per Gallon of Syrup
Sweet Sue	6.8	8.33	0.57	100.0	100.0	15
Plain Jane	3.2	6.88	0.17	82.6	30.0	40

On March 15, 1945, a sample of maple sap was exposed to acid analysis. It reduced Benedict's Solution, and had a sugar content of 0.706 according to the polarimeter. It is unlikely that this is the correct sugar content, as there may be both dextro-rotatory and levo-rotatory sugars present. The sample was stored in an ice box, and the pH taken every day. After standing for two weeks, the sap became slightly colloidal. The pH remained quite constant for a period of slightly over a month's time. It then started falling rapidly, until at the end of the experiment it was 3.98, showing that there was something present in the sap which increased the acidity of the solution. The exact reason is not known, but it is probably due to the action of an enzyme. This is believed to be an oxidation process whereby the sugar is converted to acetic acid.

Selected species of trees were tapped to determine the characteristics

of sap flow. Butternut yielded a small amount of sap; Yellow Birch and Black Birch produced somewhat more, while Gray Birch flowed freely and for a longer period.

C. L. STEVENS, STUART DUNN

Plantation Studies

Analysis of the periodical measurements of height growth of 400 sample trees in white pine plantations, some of them covering a period of five years, indicate that when using four-year-old transplants, trees less than nine inches in height should not be included in the planting stock. Trees over 18 inches tall are likely to show a mortality rate nearly double that of the smaller sizes, and should either be thrown out at planting time, or given especial care in planting. During the next few years the validity of this conclusion will be tested further.

C. L. STEVENS

FRUIT PRODUCTION

Coloring of Picked Apples

Samples of 100 McIntosh, Baldwin, and Yellow Bellflower apples were selected from single trees. Half of each sample was subjected to a fine mist of cold water during hours of sunshine for comparison with unsprayed controls.

Temperatures in sprayed fruits were from 18° to 33°F cooler during the warmest period of each day than were those of unsprayed fruits. Also, sprayed fruit started to color sooner than the unsprayed. However, after eight hours in bright sunshine, color gradually disappeared from the upper surfaces of the sprayed fruit, and in an additional eight hours the areas became increasingly brown in color.

These experiments show that surfaces of picked apples exposed to bright sunshine may be injured within eight hours. Such injury is not due to high temperatures and could occur on cool, clear days as well as on warm days.

The sprayed fruit stored well but was obviously unmarketable.

RUSSELL EGGERT

Leaf Scorch in Deciduous Fruit Plantings

Soil was obtained under McIntosh apple trees affected severely with scorch and treated in the greenhouse with (1) magnesium sulphate, 100 pounds per acre; (2) calcium limestone, two tons per acre; (3) magnesium limestone, two tons per acre; (4) control. Four replications were made of these treatments. All plots, including the control, received nitrogen in solution as 5-0-0 at the rate of 800 pounds per acre. As with turnips under previous similar treatment, no effect on growth resulted from magnesium applications. Growth with both lime treatments was not only greater, but reproductive organs appeared at an earlier date. The yield of ears of corn with calcium and magnesium-lime treatments was double that with the control or with magnesium sulphate. No scorch

occurred in greenhouse tests. In the case of oats none of the greenhouse treatments caused any increase in growth over that obtained in the control.

In orchard tests, hay mulch, seaweed mulch, and sawdust mulch have not as yet reduced leaf scorch. Magnesium sulphate applied to the soil has not benefitted trees affected by leaf scorch, although there was some reduction in the University orchards as a result of spraying with it.

L. P. Latimer, G. P. Percival

Winter Injury Among Deciduous Fruits

Continuous temperature measurements in different parts of a dormant Northern Spy apple tree were made with an automatic recording potentiometer. Maximum cambium temperatures of 84° to 93°F were recorded during February and March, on days when peak air temperatures were from 39° to 45°F.

A dormant tree of 70 pounds, cut off and stood in an erect position with its base in a tub of standard nutrient solution, absorbed from .5 to 1.0 liter of water on each of five days between March 1 and 13. Absorption was initiated by maximum air temperatures between 37° and 46°F for six days. Minimum temperatures for the period were from 19° to 40°F and cambium temperatures of the trunk (south side) were above 40°F for 6.5 to 10 hours each day. Maximum cambium temperatures on days during which absorption took place were from 69° to 93°F.

Red raspberry canes of Chief, Taylor, Marcy, Viking, and Indian Summer varieties, infected with spur blight, contained from three to eight per cent less moisture than healthy canes, on January 24. On February 2, healthy parts of diseased canes (above the infected areas) contained from .5 to 1.0 per cent more moisture than the diseased parts.

Russell Eggert

Translocation of Radioactive Elements in Horticultural Plants

Dormant Red Maple and McIntosh apple trees, respectively, were cut off on December 1, 1944, and February 1, 1945, and supported in an upright position with their trunks standing in nutrient solution in covered barrels placed in holes in the ground to prevent freezing. Hoagland's nutrient solution, slightly modified, was replaced by radioactive phosphorus in the form KH_2PO_4.

Temperatures of the trees were recorded continuously with an automatic potentiometer recorder, and the volume of nutrient solution in the barrels were measured daily. Samples for analysis were removed frequently from various depths and heights in the trees. After growth started in March, radioautographs were made of longitudinal and cross sections of the trunk and of sections of small twigs, including buds and primary leaves.

Analyses of maple samples indicate that movement of radioactive phosphorus took place principally in the young xylem. Translocation into the trunk and larger branches occurred whenever water was absorbed from the barrels.

Radioautographs of growing parts show that radioactive phosphorus accumulated in large quantities in fruit buds and blossoms and in the xylem of primary leaves.

RUSSELL EGGERT

Experiments with Blueberries

Lowbush. One plot on a high-producing area was treated with 500 pounds of nitrate of soda, and another with 1000 pounds of 7-7-7 fertilizer, on September 3, 1942. These plots made much more vigorous growth and produced more fruit of a higher grade than did the control plots. Plots on a run-out area, near-by, were given the same treatment and showed very little response.

Two plots on a run-out area which had not been burned for several years were treated with 500 pounds of ammonium sulphate and 7-7-7 fertilizer, respectively, on May 21, 1943. Vegetative growth on both plots was increased over four inches during 1943 and 1944. The 7-7-7 treatment also greatly increased the yield in 1944, and has produced a very heavy blossom set on the same plot in 1945. Control plots were nearly defoliated and did not bloom during the same period.

Other treatments with 500 and 1000 pounds per acre of the same fertilizers on June 29, July 15, and August 4, 1944, were less effective. Of these, the June 29 application of 1000 pounds per acre of 7-7-7 increased blossom formation in 1945.

A three-inch mulch of old sawdust, applied 18 months previously, has stimulated vigorous rhizome formation and spread of clons.

Micro-sulphur and powdered wood charcoal added to separate plots in 1944 have produced no apparent results.

Highbush. Bushes growing on wet clay loam soil for 11 years and heavily mulched with bluegrass hay for the last three years are all severely injured and many bushes are already dead. Plants in the patch, which was ridged to provide drainage, made from eight to 12 inches of growth in 1944 and bloomed heavily in 1945. Plants of all varieties on trial have been transferred this year to a deeper sand to gravel loam soil having better drainage.

A. R. HODGDON, A. F. YEAGER

Variety Trials and Breeding Work

Strawberry crosses involving Fairfax as a parent have resulted in most cases in firm, attractive, dark-red fruit of good flavor. A cross between Tupper and Fairfax resulted in a variety which produced very firm fruit of high quality but of relatively low yield. Crosses made between Pathfinder and Catskill resulted in plants which produced large fruit and good yield. The fruit of these crosses, however, tended to be somewhat soft in texture and of mediocre quality. Crosses involving Simcoe as one parent also produced firm-fleshed berries. Certain crosses will be used in further breeding work after selections are made for good flavor, firmness of fruit, attractive appearance, and high yield.

Crosses between certain cultivated varieties and our wild native strawberry *Fragaria virginiana* have resulted in plants with fairly high yield and resistance to drouth and winter injury. The flavor of some

of these is excellent. Crosses made between certain wild pistillate strawberries have produced offspring in which the fruit resembles the wild parent more than the cultivated parent. In another cross, in which the wild parent was perfect flowered, the resultant offspring more nearly resembles the appearance and quality of the cultivated varieties used in the cross. Outstanding in this respect were the crosses made between the perfect wild strawberry and the Howard 17, and Catskill cultivated varieties. Some of the hybrids between wild and cultivated strawberries will be used in further improvement work.

Raspberry plants set in a new location in June as young suckers from the older planting gave a much better stand and more satisfactory growth than the woody nursery plants which are ordinarily set.

A number of raspberry and blackberry seedlings are coming into bearing. One of the raspberry seedlings appeared worthy of propagation for trial as a possible profitable everbearer. In 1944, it began ripening its crop early enough so that there was a six weeks' full picking period which resulted in a fall crop of potential commercial significance. Hybrids between blackberry and flowering raspberry, *Rubus odoratus*, blossomed in 1944. They are thornless plants with pink flowers and are nearly sterile. Root cuttings were treated with colchicine and several apparently tetraploid plants produced. These have been planted for further observation.

In 1944, samples of the native hickory nut were selected from a large number of trees throughout the state. Seed from those showing the most promise were planted. They have germinated, and will be transplanted to a permanent location next year. Butternut trees from selected nuts are now 10 feet or more in height and should produce during the first favorable season.

Montmorency remains outstanding among the sour cherries and Yellow Spanish among the sweet cherries for this region. The newer varieties planted several years ago have not yet borne enough fruit to pass mature judgment. Among these Belle Magnifique shows promise.

Fredonia and Kendaia are outstanding as promising new grape varieties. Kendaia vines are more hardy toward winter cold than any of the other Labrusca or Labrusca hybrid types. Fredonia and Van Buren ripen early, but Van Buren has too strong a flavor to suit some palates. Van Buren, Fredonia, and Bluejay have proved excellent for juice.

The peach varieties which have proved most hardy to date include Oriole, Cumberland, Colora, and Eclipse. Newer varieties of apples which would seem to be worthy of attention include Beacon, Haralson, Medina, and Kendall. Of this group Kendall seems to offer the greatest commercial possibility.

Samples of seed of a muskmelon variety which carries good quality, together with the perfect flowering habit, have been sent out for trial. It has not been named and if introduced will be useful only as a home-garden kind where extreme earliness is important. The fruits are round, and green, with deep orange flesh. New crosses are being made with this to try to get a better fruit type in combination with the perfect flowers.

A. F. Yeager, L. P. Latimer, R. Eggert

HOME ECONOMICS

Studies of Palatability

Apples. The following 10 varieties of apples were canned as applesauce without addition of sugar: Yellow Transparent, Patten, Milton, Astrachan, Station, early and late McIntosh, Melba, Duchess and Whitney Crab. Samples of the last five varieties were also dehydrated and subsequently made into a sauce after refreshening with water and cooking gently.

Sauce prepared from the fresh apples of any of the varieties studied is suitable as a canned product.

Of the dehydrated samples, early and late McIntosh and Melba apples gave the better flavored product. Dehydrated apples are desirable to use in pies, puddings, and as sauce. In general, applesauce prepared from dehydrated apples rated lower than sauce canned from fresh apples.

Canned and Quick-Frozen Wild Blackberries. The resulting product formed from canning and quick-freezing two types of wild blackberries indicated that wild berries are especially palatable when treated in this manner. Because of the variety these fruits can lend to the diets of New Hampshire families, their preservation should be encouraged.

Quick-Frozen Cantaloupe. The appearance, texture, and flavor of quick-frozen sliced cantaloupe prepared in the following manner was found to be very desirable and palatable. The sliced product, ½ inch thick, was thoroughly blanched, immediately chilled, and packed with a medium syrup. The enzyme action must be completely arrested to obtain a good product. Because of resulting poor texture and flavor, whole untreated cantaloupe is not recommended for quick freezing.

Canned Korean Cherries. (Station varieties #60 and #20.) When these two varieties were canned with a medium sugar syrup, it was found that they made a desirable canned product and should be canned when available.

Fresh Rhubarb Prepared as a Sauce. The fresh rhubarb sauce of varieties tested rated as follows for total desirability: Valentine (most preferred), McDonald, Early Sunrise, and Canada Red.

Grapes Prepared as Grape Juice. Juice was extracted and then pasteurized from Fredonia, Van Buren, Kendaia, Concord, and Westfield grapes. The unsweetened juices from Van Buren and Fredonia were the most desirable. Sweetening slightly improved juices of Kendaia and Concord varieties.

Canned and Quick-Frozen Peaches. Of the 14 varieties of locally-grown peaches, New Jersey #122, Colora, and Eclipse were found to be exceptionally good varieties both for canning and quick-freezing. The Duke of York and Marigold varieties, either canned or quick-frozen, were judged lower than any other similar product from the other varieties for total desirability. Yellow peaches are preferred over white, both for canning and quick-freezing.

Canned and Frozen Pears. Of the nine varieties canned, Clapp's Favorite was judged the most desirable, followed by Howell, Tyson, Sheldon, and Lawrence. Anjou, Keiffer, Bosc, and Seckel were also studied but did not yield canned products of as high quality. When Tyson and Clapp's Favorite were frozen they were not rated as high as the canned product, due principally to a change in texture.

Strawberries. During a period of nine months, fresh and quick-frozen Catskill strawberries were studied for palatability. Three methods of quick-freezing were used for treating the berries: whole, whole treated with 50 per cent syrup, and whole blanched. After three months of storage at 0°F, samples frozen with syrup were preferred over the whole or blanched berries. The blanched berries lost considerable color. When the samples were blended, and syrup was added to eliminate variations in sweetness, the judges were not able to detect any differences in flavor. When the blanched and whole berries were blended without syrup there was a slight preference for the whole berry.

After six months and nine months of storage, strawberries treated with syrup were again preferred. Berries treated with syrup consistently hold their color, shape, texture, and flavor better than whole or blanched samples without syrup. Blanched berries lost color, but the flavor was slightly better than the whole berries.

String Beans. The Bountiful variety of green beans was studied for palatability as fresh, home-canned, commercially-canned, and quick-frozen products. The samples were scored as fresh, and after three, six, and nine months of storage. Both distilled and brine water were used. The commercially-canned products were canned in the municipal cannery at Dover, New Hampshire, using city water.

After three months of preservation the quick-frozen product rates highest among the three methods of preservation. The commercially-canned beans scored higher in size, shape, and texture but the color and flavor were less desirable than the quick-frozen samples. Home-canned beans scored lowest for all factors. The distilled water products were slightly less preferred to the commercially-canned product, using city water.

After nine months of storage the quick-frozen product was again preferred, but the total desirability for quick-frozen and commercially canned beans, although higher than for home-canned, declined. Texture showed the greatest decline in the case of quick-frozen beans, whereas flavor declined most in the commercially-canned product. The home-canned product improved in flavor.

Squash. Freshly harvested squash was preserved by canning, quick-freezing, and dehydrating. Samples were stored until April when they were tested for palatability. The quick-frozen product proved more desirable in all factors. Dehydrated squash was not as desirable as canned squash in color, moisture, and texture.

Samples of Blue Hubbard were canned two weeks, three months, and six months after harvesting. Squash held three months before canning was more palatable than samples freshly harvested or samples held for six months. The freshly-harvested squash was too dry, too firm and

less sweet. It is recommended that Blue Hubbard squash be canned at about three months of storage after harvesting, in order to get the best quality.

T. LEVCOWICH

INSECT CONTROL

Penetration and Toxicity of Contact Insecticides

Techniques devised for exploring new chemical compounds as insecticides were continued during the current year. Scores of new compounds have been studied as possible toxic agents in a contact spray. In each case a compound is given an initial screening test in which it is incorporated at 5.0 per cent in a household spray kerosene, and is applied under controlled conditions to five-day-old adult houseflies specially reared for the purpose. If it gives no performance under these conditions it is considered to offer little promise. If it kills 30 per cent or more of the flies, it qualifies for further study. The spraying technique is so set up as to give 50 per cent mortality of flies when using a standard reference material at 5.0 per cent concentration.

A second technique which is used with more promising materials involves application to pea aphids under standardized conditions. Here an arbitrary concentration is used which should give 50 per cent or more mortality if a compound is to be given further attention.

Basing the research program on these techniques, two groups of compounds have been discovered which give promising performance. In each group about 30 related chemicals have been studied. Several in each group stand out encouragingly. In one group a compound was discovered in April which appears to be in a class by itself. The exact chemical configuration of this compound is not yet known with certainty, although its general structure is determined. For the present, therefore, it is designated merely as No. 431, which is its serial number.

Since a contact insecticide may find its widest practical use when applied in dust form, attention has been given to this aspect of the subject. If the compound is a solid, it may be well pulverized and diluted with an inert. This was done with No. 431. Since fineness of division of a compound may be critically important in its performance, a mikropulverizer was added to the laboratory equipment and is in active use. Where a new compound is in liquid form the department has studied means of incorporating this liquid with an inert. This can be accomplished in either of two ways: first, by incorporating the liquid in a limited amount of inert and then diluting to a satisfactory dusting condition; second, by atomizing a small percentage of the liquid directly into the inert.

In the studies of new compounds as contact insecticides, several have been discovered which are repellent to insects. Some of these give promise in that direction.

The department study of aerosols continues. A special room equipped for this purpose serves the exacting needs well. New formulas are under examination. Two or three of the new compounds discovered

in the department's research have been tested in aerosols and one of them looks promising, since it can be incorporated in liquefied Freon without added solvent, and since it gives high mortality of the test insects at relatively low concentrations.

During the summer of 1944, DDT, in the form of sprays and dusts, was used in a number of plots for the control of potato insects. Generally speaking, DDT dust gave more satisfactory control of potato insects than did the DDT spray. The spray applications appeared to be about as effective as standard calcium arsenate applications. (In the DDT sprays the material used was *Gesarol AK 20* at the rate two pounds per 100 gallons of water.)

A dust containing 3 per cent DDT gave especially good results against potato flea beetles, and Colorado potato beetles. In some plots the dust gave an increase in yield of 63 bushels per acre over that obtained in plots sprayed with calcium arsenate at the rate of six pounds to each 100 pounds of Bordeaux mixture.

In the control of potato aphids, DDT appeared to act quite slowly. It could not be depended upon to reduce a very heavy population of aphids within any reasonable period of time However, it is anticipated that aphid control in potato fields might be accomplished if applications were begun early in the season and were repeated several times, so as to prevent the initial buildup of aphid population. It is planned to continue this sort of experimental work during the forthcoming season.

W. C. O'Kane, J. G. Conklin, L. C. Glover, W. J. Morse

Penetration and Toxicity of Ovicides

In order to determine the effect of the addition of DDT to dilute oil sprays in the control of European red mite on apple, DDT in the form of *Gesarol AK 20* was combined with Niagara No. 6 dormant oil in delayed dormant applications at the Horticultural Farm orchard. Three plots were used in the experiment. Plot No. 1 received a standard application of 3 per cent oil, only. Plot No. 2 received an application of three gallons of oil plus two pounds of *AK 20* per 100 gallons. Plot No. 3 received one gallon of oil plus two pounds of *AK 20* per 100 gallons. Complete control of the European red mite was obtained in all three plots, while near-by trees, unsprayed, showed severe damage by the red mite. The degree of control obtained is attributed to the fact that red mite eggs were just beginning to hatch at the time the sprays were applied, and were paricularly susceptable to oils of low concentration. Although the DDT did not decrease the toxicity of the oil sprays, it did not add greatly to the toxicity of the oil.

W. C. O'Kane, J. G. Conklin

Insect Record

In the summer of 1944, an outbreak of the lesser migratory grasshopper caused serious damage to hay and grain crops in the Merrimack Valley. Injury was accentuated by drouth conditions and resulted in a total loss of crops in some instances.

There was an outbreak of canker worms in localized areas of the state, causing heavy defoliation of elms, particularly in the Merrimack Valley.

The black army cutworm which caused such destruction in the blueberry sections of Maine occurred only in one small area in southeastern New Hampshire and caused no serious damage.

J. G. CONKLIN

Apple Maggot

In the summer of 1944, DDT was used in the control of the apple maggot at the Horticultural Farm. Three plots were used in the experiment. In plot No. 1 DDT in the form of *Gesarol AK 20*, at two pounds per 100 gallons of water, was applied twice for the control of apple maggot. In plot No. 2, DDT was used only in one application, and in plot No. 3, the standard lead arsenate program was carried out, for comparison. In the control of the apple maggot *Gesarol AK 20* spray was only slightly superior to lead arsenate. The omission of one cover spray in plot No. 2 resulted in somewhat poorer control. On the basis of the work carried out in 1944 it would appear that increased dosages might prove to be of practical value in the control of apple maggot in New Hampshire. However, it is expected that DDT in the form of dusts may give better results in the control of the apple maggot. It was planned to carry out such a test as opportunity presents itself during the coming season.

In the course of the above experiment it was found that DDT gave very poor results against the plum curculio, but gave satisfactory results against apple aphid.

J. G. CONKLIN, W. C. O'KANE

Studies on the Ecology of European Spruce Sawfly

The European spruce sawfly continues to maintain itself at a low population level in southern New Hampshire, also in the extreme northern part of the state. In stands of spruce visited during 1944 the spruce sawfly could be located readily, but in no instance was defoliation noticeable.

Cocoons of the sawfly collected and brought to the laboratory yielded some of the parasite, *Microplectron*, which had been liberated during the year when the spruce sawfly first became a serious pest. It is interesting to note that the parasite is apparently able to maintain itself even when the spruce sawfly is at a very low population level.

Some scouting for the spruce budworm was carried on during the season of 1944, and again during the early part of June, in 1945. In 1945, the spruce budworm was found at several points in the towns of Clarksville, Pittsburgh, and Colebrook. Fortunately, no evidence of spruce budworm defoliation was found. Timberland owners have been informed of the possibility of an outbreak occurring some time in the relatively near future, and they have been advised to contact the department im-

mediately if any evidence of spruce budworm injury to their spruce stands is discovered. The department plans to continue its scouting for evidence of an outbreak of this serious pest.

J. G. Conklin

ORNAMENTALS

Carnations

Twenty-four varieties of carnations were tested for quality and production during the past season. The six outstanding varieties under local conditions are: King Cardinal (scarlet), Olivette (white), Rocalis (dark pink), Peter Fisher (pink), Pollyanna (salmon pink), and Seth Parker (crimson).

To determine the optimum amount of soil nitrates for carnations, randomized plots were set up in the greenhouse with soil nitrates maintained at five levels varying from very low to very high. Two replications were made of each treatment. The nutrition, other than the nitrate, and watering were kept as uniform as possible in all plots.

The growth in all plots except those with very low nitrate was uniformly good. Production was slightly lower in the low nitrate plots but stem length was not affected. The plants grown in these plots were somewhat lighter in color, the leaves were narrower, and the stems were more wiry but just as strong as those receiving sufficient nitrate. Plants receiving insufficient nitrate produced fewer side shoots. Although 1 *ppm.* of soil nitrates is not enough for optimum growth of carnations, this work must be carried further to determine the exact optimum or near-optimum level.

Self-pollination of parent lines is being continued to obtain pure lines for eventual use in hybrid seed production. Progress is well along with the hoped-for hardy carnation. A perpetual flowering hybrid between *Dianthus plumarius* and the greenhouse carnations has been backcrossed with several varieties. The resulting seedlings, which closely resemble carnations, will be tested this coming winter for hardiness.

Chrysanthemums

Hardy varieties have been originated and either have been, or soon will be, introduced to the trade. These include:

Exeter — yellow, large, full, double reflex flowers, 15 inches tall, two feet spread; blooms about September 20.

Franconia — gold, cut-flower type, large pompon, reflex, good placement and spray formation, 36 inches tall; blooms September 20.

Monadnock — bronzy red, button-type flowers; blooms in August and September.

Merrimack — orange, reflex, one and one-half to two inches in diameter; excellent for mass color effects in garden during late September and late October.

Sunapee — rich gold, full double pompon, cut-flower type, height 36 inches; blooms September 15.

Nashua — bronze, full, double, incurved flowers, cut-flower type, height 30 inches; blooms September 1 to 20.

Mascoma — light yellow, full, double reflex, dwarf and well-branched; blooms October 10; lacks hardiness, used for pot culture only.

Begonia

Studies were made on the inheritance of doubleness, flower color, foliage color, and plant habit. In the process of this work, double-flowered varieties of begonias in all colors common to the species, as well as double-flowered varieties with dark foliage, have been developed. One of our leading florists' seedsmen is co-operating to perfect hybrid seed production for the florists' trade.

Penstemon

With the aid of students, a number of inter-specific hybrids of Penstemon have been made. This genus contains some very desirable garden perennials and improved hardy forms will be welcome to the home gardener as well as to the commercial nurseryman. Two years are required to flower plants from seed. The first two F_2 generations will flower during the summer of 1946.

Saintpaulia

Hybridization and the testing of seedlings are being continued with this fine house plant. Through the co-operation of growers over the country, we have collected some 20 or more varieties with duplicates from several sections of the country. These plants will be flowered here to determine which varieties have more than one name and to assist in determining the correct nomenclature of African violet varieties.

Forsythia

Crosses have been made between *Forsythia ovata*, *F. suspensa*, and *F. intermedia* in an attempt to incorporate more hardiness in the flower buds of this popular shrub.

Lilac

Several hundred lilac seedlings planted four years ago have now blossomed. One of these, an unusually fine purple variety and differing from all the 150 named varieties in the lilac arboretum, has been selected for naming and propagation under the name of *Anne Tighe*. Several hundred more lilac seedlings from controlled crosses were planted in the spring of 1945, for the purpose of studying the inheritance of color and the production of better pink varieties and, also, later blooming varieties.

Other Investigations

Sweet Pea and Gladiolus variety trials are now being conducted.

The experimental work on house plants is completed and being published as Station Bulletin 359. Exact cultural information, and general notes on propagation and insect control on plants in the house are included, with numerous illustrations.

Work on the Lily-of-the-Valley continues with an investigation of strains of planting stock.

W. D. HOLLEY, JAMES MACFARLANE, A. F. YEAGER

PASTURES

Pasture Management Studies

As originally conceived, methods and costs of brush removal indicated the possibilities of expanding good pasture area by further clearing, adequate fertilizing, shifting of some crop land to pasture, and plowing and seeding suitable areas. The use of a bulldozer was used to clear, level, and seed about 10.5 acres of rough pasture. The expense involved, under present rates of bulldozer hire, seems too great for pasture land. On this one farm 10.5 acres of pasture land were leveled and trees and rocks were removed at a cost of $706.56, or $67.29 per acre. Conditions for bulldozer operation were not good. The soil was wet and four inches of snow fell during the course of the operation. It is believed that it took about a third longer to do the work and the results were not as satisfactory as they would have been if done in August. The use of a bulldozer is, however, an effective way for removing brush, trees, and rocks, and for leveling hummocky land.

In this instance, as the result of a pasture program starting in 1937, all cows and heifers were pastured at home with no barn feeding of hay for two pasture seasons. During this time, grain was reduced from 300 pounds to 100 pounds per day, or a reduction from full winter to one-third of a winter grain ration.

The improvement program by clearing began with 13.3 acres of plots on 15 farms. It has now expanded so that on these same 15 farms there are 82.5 acres of improved pasture from which brush has been removed, 22.5 acres plowed and reseeded, 13.5 acres fitted with the bush and bog harrow and reseeded, and 10.5 acres leveled with the bulldozer. Six farmers have terminated their co-operation, five have not increased the original cleared area, leaving eight that have now expanded the improved pasture area. Three have been added to the original group.

Some of the new chemicals for killing brush will be tried out this summer.

M. F. Abell

Eradiction of Weeds from Permanent Pastures

Buttercup. Some success in eradicating the buttercup in permanent pastures was attained by the use of ammonium sulfamate at $^3/_{16}$ of a pound per gallon of water. The use of borax also gave some promise of success at concentrations ranging from 1 to 4 pounds per 100 square feet.

On the basis of these preliminary results, more plots were laid out in Durham and at North Haverhill to discover more exactly the proper time and other conditions for application. Applications of ammonium sulfamate at $^3/_{16}$ pound per gallon of water, made June 20, in Durham, gave almost complete control in 1944. Other applications on June 3 and about the middle of July were less effective. The application on June 28 gave only temporary injury to grasses. By midsummer, these plots were

being grazed more than adjoining untreated areas. Other weeds, notably *Antennarias* or everlastings, rushes and sedges, were effectively destroyed. Some white clover either persisted or seeded in on all plots treated with ammonium sulfamate.

On June 28, plots were laid out and borax applied. Excellent control was obtained by the application of 2 pounds per 100 square feet. The soil was a heavy clay and fairly dry. Applications of 1 pound of borax per 100 square feet at this time of year and under these conditions did not give satisfactory control of buttercup.

Yellow Devil's Paintbrush or King Devil Considerable interest has been centered in the control of this serious pasture and field weed. Preliminary trial plots were established in a permanent pasture at Rollinsford . Ammonium sulfamate, borax, and sinox were each used at several concentrations and at different times. A late June application of ammonium sulfamate, at $^{3}/_{16}$ pound per gallon of water, gave excellent control by destroying virtually all of the weed and providing conditions for the almost complete return of grasses and clover during the summer. The results with sinox indicated its possible use also in controlling the King Devil.

Other Pasture Weeds. At various times, a variety of weed species have been treated with the herbicides described. The results, while not conclusive, do indicate a wider possible use of selected herbicides for eliminating pasture weeds.

A. R. HODGDON, F. S. PRINCE

Pasture Species

During the year, some of the rod rows were discontinued due to the heavy soil type and lack of labor for caring for the area. The remaining rows are chiefly those of the uniform grass nursery which includes the following: smooth brome grass, 8 strains; Kentucky bluegrass, 11 strains; meadow fescue, 6 strains; orchard grass, 2 strains; and red fescue, 8 strains. In addition to the above there are a few scattered rows of various species for observation.

Green weights were noted from two harvests. Yields were generally lower than in the 1943 season because of the two periods of extended drouth in 1944. Yields of smooth brome grass averaged higher than meadow fescue. Second cuttings were much lower than the first except in the case of orchard grass.

L. J. HIGGINS, P. T. BLOOD, F. S. PRINCE

Improvement of Ladino Clover, Red Clover and Timothy by Selection and Breeding

Ladino Clover (Trifolium repens). Twenty-four plants were selected and numbered in the autumn of 1943. These represented original Ladino parents and superior individual plants of the F1, F2, and F3 generations of stock obtained by intercrossing large, wild, white clovers and Ladino in the F1 generation and back crossing to Ladino in the F2 and F3 generations.

The selected plants were propagated clonally in the greenhouse during the winter. Cuttings of plants 1 to 9 were set in triplicate for caging. As the season developed, bees were introduced into the cage and seed was secured from each plant. This seed now awaits propagation and the progeny will be subjected to further testing.

All 24 plants were used for testing in small plots. Clonal material from each was set in triplicate plots, 3 x 6 feet, 14 cuttings per plot, on land that had been seeded currently to orchard grass. Competition, height, ability to recover after clipping, and similar factors are being noted.

A few of the 15 plants in this group, not caged in 1944, appear to have more promise than many of the nine that were caged; hence, the cage will again be used in 1945, with a new grouping for seed production of the most desirable material.

Plant materials from other stations are being subjected to similar field tests.

Red Clover. Twenty-five potted seedlings were brought into the greenhouse for the usual winter crossing. These seedlings represent the more persistent of the 12 families selected for their ability to live more than two seasons; F1, F2 and F3 generations are obtained by intercrossing.

This year, none of the old plants of the 12 original families were alive in the field plots. Some of the original plants had produced seed as many as four or five seasons. Seed multiplication has continued both in the field and in the plot areas. In spite of excess winter killing of all plants, there are a few plants that now are three years old.

From now on an attempt will be made to discard plants that show disease and general lack of vigor, and to test bulk seed of this new strain along with other standard and improved strains. After this selection and testing, an effort will be made to multiply the strain rapidly if it shows sufficient promise.

Timothy (Pleum Pratense). Due to unfavorable soil conditions on the area in which seed from clonally propagated plants were seeded, it was impossible to check the behavior of individuals in the two strains of timothy under observation. In the spring of 1945, seed from each clone will again be planted for testing.

Plantings of composites of each strain have been made for seed increase. About 50 pounds of the late hay and five pounds of seed of the pasture strain were secured in 1944. This seed will be tested in 1945, probably in some trials on farms.

F. S. Prince, L. J. Higgins, P. T. Blood

Producing the Full Roughage Requirements on New Hampshire Dairy Farms with Special Reference to Pastures

This study is carried out on eight pastures, seven of which were seeded in 1942 and one in 1943. Seed mixtures included Ladino in all cases, supplemented with strips or plots of one or more of the large grasses, namely, timothy, orchard grass, smooth brome grass, reed canary grass, tall fescue and perennial rye grass. A study of seeding rates is included on two farms.

Difficulties in management have been encountered because of the fact that in no case were the plots larger than an acre, too small in fact to fence and pasture separately. In two cases, the grasses have been grouped or divided, two or three in each area but this method has not permitted the best management because of the difference in time of maturity. In one case the cows were turned into an area of timothy, orchard, and reed canary grass at a time when both timothy and reed canary were at the correct stage for pasture; but the orchard grass was too far along and was not eaten by the animals.

Areas large enough to serve as pasture units are being seeded to simple mixtures in 1945, *i.e.* one grass with Ladino clover. This will permit proper management of each area. Such a method will have the disadvantage of involving wide soil variations, but probably will be more useful in noting the competitive effects of each of these grasses on Ladino. Furthermore, it will permit the keeping of milk production records for the various areas. Competition between some of the finer grasses such as red top and Kentucky blue grass will be eliminated, except as they volunteer into the stand.

The investigation has two major objectives, the answers to the following questions: Are any of the grasses more productive than others during the midsummer or short pasture season? Do the grasses offer too much competition for Ladino clover? A good stand of Ladino or a Ladino mixture is more productive in July and August than a stand of any one of the grasses during that period. Moreover, Ladino clover is higher in protein and minerals and perhaps more nearly represents the ideal forage for high-producing dairy cows. Interest in the grasses centers around these points: first, a mixture usually gives a higher total yield than Ladino alone; second, grass adds some variety to the diet of the animal; third, grasses start growth earlier in the spring than Ladino, hence, they furnish the early bite; fourth, grasses are not so susceptible to winter killing; fifth, the association with grasses affords some protection from winterkilling the Ladino clover.

Of the grasses under study, orchard grass is, undoubtedly, the earliest for pasturing. It is followed closely by smooth brome, with the others coming along at about the same time. In July, orchard grass, smooth brome grass and reed canary are more productive than the others, while, in the fall, tall fescue appears to make the most growth. This is followed closely by reed canary grass. These two grasses on wet land would undoubtedly be reversed in respect to fall growth as reed canary appears to be particularly adapted to wet areas. Drainage and fertility have a tendency to cause variations in respect to seasonal growth.

The palatability of these grasses ranks as follows, in descending order: smooth brome, timothy, perennial rye, reed canary, orchard grass and tall fescue. There is some doubt as to whether or not tall fescue, because of its harshness which is closely associated with palatability, has a place in pasture improvement. Farmers generally agree that smooth brome ranks high in palatability, possibly higher than all the rest.

According to results in 1943 and those of one pasture in 1944, there

is some doubt as to the economy of using very much nitrogen in pastures where Ladino forms a considerable portion of the stand.

Competition of each of the grasses with Ladino is being studied in those pastures in which Ladino still persists. Estimates indicate that reed canary grass offers the most competition, tall fescue second, and orchard grass third. Smooth brome, timothy, and perennial rye follow in this order but are quite similar in this respect.

Two of the pastures that are being studied contain plots on which orchard grass has been seeded at different rates In one instance, 3, 6 and 9 pounds per acre were seeded, whereas, in the other, 5 and 10 pounds were used, with uniform Ladino in both cases.

At the end of 1944, there was 5 per cent more Ladino in the two lighter seedings than on a heavier orchard grass seeding, but there was no observable difference in percentage of Ladino or orchard grass in another instance.

Three comparisons are available in which yields of large grasses with Ladino may be contrasted with complex commercial pasture mixtures. The data show an advantage in yield for the simple mixtures as compared with the complex pasture mixtures in which several grasses are used with Ladino clover. Stand estimates indicate that red top and Kentucky blue grass, both sod forming, occupy too much of the stand within a year or two in the case of complex mixture areas. These two grasses are not high yielding and afford too much competition with the Ladino clover. They also tend to crowd out the timothy under grazing conditions. With less productive species occupying the sward a lower yielding and less palatable pasture will result.

F. S. Prince, P. T. Blood, G. P. Percival

PLANT PATHOLOGY

Control of Tomato Diseases

Three phases of the tomato-disease problem were investigated during 1944-45 as follows:

1. *Late blight.* Continuing the work started two years ago, several more varieties of tomatoes were obtained and tested for resistance to *Phytophthora infestans.* None of the many selections obtained and inoculated so far have shown immunity to the late blight pathogen.

2. *Spray treatments.* Three fungicides, Copper oxychloride sulphate, Bordeaux mixture and Fermate, were used, in 1944, on tomato plants of the New Hampshire Victor variety for the purpose of determining their effect on the control of Alternaria blight. The total yield of fruits per plant was not significantly increased by Copper oxychloride sulphate or Fermate. The yields were actually decreased by applications of Bordeaux mixture. However, a significant increase in marketable fruits was obtained by the use of the three materials and at all concentrations. Defoliation was high in all cases at the end of the season, September 7, but defoliation was sufficiently retarded to permit the production

of significant increases in marketable fruits. Fermate at the recommended strength of 1-100 gave higher yields of marketable fruits than any of the Copper oxychloride sulphate or Bordeaux mixture treatments.

3. *Physiological maturity*. In 1944, further investigations were made on the physiological maturity of tomato plants and its relationship to Alternaria blight.

Attempts to keep plants of the New Hampshire Victor variety physiologically young during the fruiting period by the addition of nitrogenous and complete fertilizers were unsuccessful because of a lack of sufficient rainfall during August to make the soil nutrients available for plant use.

It had been shown from earlier work that a plant with a heavy fruit to leaf ratio reaches physiological maturity earlier and is thus more subject to Alternaria blight than one with a low fruit to leaf ratio. Further evidence on this phase of the problem was obtained this year. When only half the normal number of fruits was allowed to remain on certain plants, the number of marketable fruits was increased and defoliation was decreased on these plants as compared to the check plants. Certain tomato varieties, because of their high fruit loads, reach physiological maturity earlier than other varieties with lighter fruit loads; thus, they defoliate sooner because they become susceptible to Alternaria blight earlier in the growing season.

M. C. RICHARDS

Factors Influencing the Development or Suppression of Leaf Roll Symptoms in Potato Foliage

During previous years, while making tests in the greenhouse for virus detection in potatoes, Green Mountain tubers known to have net necrocis did not always produce plants showing leaf roll. Environmental conditions were thought to influence the production or suppression of the leaf-rolling symptom. In preliminary tests with Green Mountain plants grown in the greenhouse during February, March, April, and May, it was possible by adding nitrogen as Ammonium nitrate or a complete fertilizer (8-16-16) to the soil to completely mask foliage symptoms of leaf roll. On the other hand, when the plants were growing in soil containing triple superphosphate without additional nitrogen being added, leaf rolling was pronounced and the leaves took on a glossy appearance, a symptom often associated with this disease under field conditions. When potassium chloride, only, was added to the soil, the plants were severely stunted and yellowed. The leaves showed severe rolling but definite leaf-roll symptoms were masked by the stunting and yellowing of the plants.

In addition to soil cultures, healthy and leaf roll plants were grown in water cultures by means of special boxes so placed that the roots were permitted to enter nutrient solutions in jars below. The tops and tubers were supported above in excelsior-peat mixtures. This proved successful in securing vigorous plants and may be used in more exact work concerned with the effects of nutrients. Consistent with soil cultures, additions of nitrate tended to suppress leaf-roll symptoms.

M. C. RICHARDS, STUART DUNN, R. C. JONES

Spraying for Apple Scab

Heavy and frequent rains during April and May, 1945, hastened the discharge of the primary inoculum so that practically all ascospores had been discharged by May 25 as contrasted to the previous year when viable spores of the apple scab fungus were being discharged as late as June 23. As a result of the very wet weather, 1945 promises to be one of the worst scab years experienced by New Hampshire growers. From preliminary tests, Puratized N5-E and Isothan (Q15) seem to have promise for future use as protective sprays for scab control. In spite of the favorable weather for scab this year, Fermate and micronized sulphur have given good control on McIntosh and Spy apples when applications were properly timed.

M. C. Richards

The Testing of New Pesticides

This project has been recently set up to determine the fungicidal value of some of the newly developed spray materials for plant disease control under New Hampshire conditions.

Two applications of Puratized N5-E at 1:10,000 were found to be very useful for the control of powdery mildew on sweet peas, but was injurious to greenhouse-grown roses. The spray materials Isothan, Fermate, Dithane, Spergon, Arasan, and others, are now being tested to determine their effectiveness for control of root rots, defoliation diseases of tomatoes, and apple scab.

M. C. Richards, R. C. Jones

POULTRY

Protein Requirements of Chickens At Various Stages of Growth

The war emergency has limited the supply of animal and marine proteins available. Therefore, emphasis has been placed on utilization of the vegetable protein soybean oil meal as a protein supplement in breeder rations containing no animal protein.

Following a period of 224 days on test, 20 pullets on a meat scrap ration averaged 69.2 pounds of feed consumed and 131.5 eggs per bird which hatched 82 per cent. Twenty pullets on a soybean oil meal ration averaged 70 pounds of feed consumed, and 132.8 eggs per bird which hatched 76 per cent. There was no mortality in either group and body weight maintenance was satisfactory.

The results obtained this year with soybean oil meal are more favorable than those obtained in the past, particularly in regard to hatchability. With increasing information on soybean oil meal, it appears that this protein supplement can be used with reasonably satisfactory results as the only protein supplement in poultry laying and breeding rations.

Choline has recently been shown to be important in the nutrition of poultry and a relationship established between the amino acids cystine and methionine and the compound choline. Choline can substitute in

part for methionine and cystine. Animal and marine protein are good sources of all three of these compounds while present information indicates that soybean oil meal is most likely to be deficient in methionine. In view of the unknown requirements of laying hens for choline, it is possible that additional choline might improve the nutritive value of soybean oil meal.

In the present trial, doubling the amount of soybean oil meal in the ration or supplementing the soybean oil meal rations with added choline gave less satisfactory results.

A reliable method for the chemical determination of choline is needed and attention has been given during the year to this problem.

R. C. RINGROSE, T. B. CHARLES, S. R. SHIMER, H. A. DAVIS

The Cause and Prevention of Gizzard Lesions in Poultry

At the present time, poultrymen are apparently less concerned about the presence or absence of gizzard lesions in growing chicks than formerly. However, the fundamental cause of this condition is still unknown. Contrary to field observations, the presence or absence of gizzard lesions has no effect upon the growth of chicks in the laboratory.

Inability to uniformly produce the condition has made it difficult to interpret the results of corrective measures applied. Using one mix of feed for three different experiments with chicks gave gizzard scores, the measure of results, of .34, .59 and 1.18. The higher score indicates a more serious condition. Growth results were comparable in all three experiments. Additional work toward uniform experimental production of the condition is planned.

A more accurate method of measuring results than the visual scoring used in the past has been studied. This consists of a cholic acid determination on the gizzard lining since cholic acid when added to the feed has a very marked protective action. In one experiment two control groups gave an average score of .98 with an average of 7.07 *mg.* of cholic acid per gram of dried gizzard lining. Supplements of cholic acid or whole milk markedly reduced the gizzard score and increased the cholic acid content of the gizzard lining. Egg yolk also reduced the gizzard score, but there was little effect on the cholic acid content of the gizzard lining. As measured by the gizzard score alone, 5 per cent alfalfa leaf meal or 10 per cent ground oats had only slight preventative action.

R. C. RINGROSE, E. F. WALLER, T. B. CHARLES
S R. SHIMER, H. A. DAVIS

Transmission of Pullorum Disease to Adult Birds

Bacteriological cultures of swabs were made from the cloacas of reacting birds. One trial was run by feeding *Salmonella pullorum* mixed with feces. A few blood tests have been made to determine the speed of development and consistency of the agglutination titre.

Feeding *Salmonella pullorum* mixed with feces produced the disease within two weeks, the same interval required by feeding pure cultures

as was done during the previous year. There were 32 swab cultures made from eight birds giving a positive agglutination titre to pullorum disease. All of these cultures were negative to *Salmonella pullorum.*

Apparently reacting birds are not at all consistent in discharging *Salmonella pullorum* organisms in the feces. Exposure to the causative organism will readily produce Pullorum Disease in adult birds.

A. C. Corbett, F. E. Allen

Anthelmintics in Poultry

A total of 18 compounds from the group known as sulfones were tested on two-week-old chickens to see if they would control or prevent coccidiosis. Of this group 13 had no protective value, four were rated as fair, two were toxic when fed over a period of time, and one was considered as good on two trials.

Six compounds were tested as anthelmintics against the common, large, round worm of chickens. One of these, a stabilized nicotine compound, was found highly efficient, but the dosage had to be controlled very closely.

This same nicotine-bearing compound, when diluted with wetable sulphur, was found to be an excellent lousicide for chickens. The residual effect lasted long enough to destroy the young lice as they were hatched. Four commercial louse powders were purchased and comparative trials made. The experimental compound was superior to all four in both the initial kill and in the residual effect. It was equal to, but not superior to, DDT when used in the same proportion and with the same diluent.

Toxicity trials with DDT were made on chickens, rats, and rabbits. Chickens are not as susceptible to DDT when taken internally as are the two species of mammals. It did not remove the ascarids or caecal worms from these birds.

E. F. Waller

Contagious Indigestion (Blue Comb)

Twelve poultry flocks containing 44,000 birds were inoculated with the chick-embryo-prepared vaccine. Eight of the 12 farms reported no trouble from blue comb. One farm reported the usual outbreak without resorting to laboratory examination and diagnosis. Of the remaining three farms one reported one case in 2500 pullets, the second 18 cases in 1600 pullets, and the third only two cases out of 3300 inoculated birds.

During the winter, sufficient vaccine was produced by the egg-embryo a method to inoculate 40,000 to 45,000 birds in 1945.

F. E. Allen

SOILS

Methods for Controlling Erosion on New Hampshire Potato Farms

During 1944, for the second consecutive year, the winter rye cover crop plots outyielded the plots which were left bare over the winter. The increase in yield of U. S. No. 1 potatoes was 17.2 per cent. Run-off soil losses during the year, although relatively low, were almost twice as great

from the bare plots as from the rye plots. Thus, the advantages of growing winter rye in minimizing soil erosion and increasing the yield of potatoes are grown continuously in an accelerated production program were definitely indicated during the past season, the fifth in the sequence of potato culture on the experimental plots.

Topsoil-subsoil interrelations with soil fertility were studied in greenhouse trials with Paxton sandy loam, a soil type valuable for potato culture. That losses of topsoil and a mixture of subsoil by tillage processes may markedly depress yields is strikingly indicated in the following table.

Topsoil-Subsoil Experiment (Paxton sandy loam)
Yield* of Oats (Grams per pot)

% Topsoil % Subsoil	100	90 10	75 25	50 50	25 75	 100
Unfertilized Check	12.6	13.8	10.1	8.4	5.4	2.9
N**	11.5	11.7	10.0	6.8	6.6	4.5
P	17.3	15.9	14.75	12.0	9.5	7.0
NP	16.2	16.1	14.5	13.5	12.7	13.0
NPK	17.0	16.8	15.7	14.3	13.5	13.7

*Yield represents average of two pots and consists of oven dry tops, including grain.
**N, equals 100 lbs. of nitrogen as 16% N-aNO_3.
P equals 400 lbs. of P_2O_5 as 20% superphosphate per 2,000,000 lbs. of soil.
K equals 100 lbs. of K_2O as 60% KCL.

The effect is apparently greatest upon phosphate, inasmuch as the topsoil phosphate reserve was initially limiting to a greater degree than the topsoil nitrogen reserve. Chemical and physical studies of this same problem are being carried forward in the laboratory, and field plots with 0 per cent, 50 per cent, and 100 per cent of the topsoil removed were established this spring.

L. T. KARDOS

The Influence of Soil Texture, Soil Moisture, and Soil Aeration on the Growth of Plants

Two soil types, a fine sandy loam and clay loam, were sifted into a coarse fraction and a fine fraction. Plants of corn, barley, and two varieties of tomatoes were grown in these and in natural or unsifted soil. Tomato and cabbage plants were grown in sand cultures of two textures. Cabbage plants also were grown in cinders sifted into two fractions. Modifications of these with aeration and with additions of colloidal clay and a hydrophillic, organic colloid, methocel (methyl cellulose) were tested also.

The yields of dry weights from corn and barley in soil were reversed in relation to each other, barely showing greater yield with clay, while corn showed greatest with sandy loam. The sifted fractions within a given soil type did not show outstanding differences. Apparently, within the limits of these experiments, texture does not influence growth of these grain crops materially. This is in agreement with results re-

ported previously for barley and sunflower in synthesized soil. Tomatoes in soil culture gave a difference in varietal response. The late variety yielded better in the sandy loam while the early did better in clay.

The sand cultures gave results similar to those of previous years by giving greater yield with fine texture. This relationship was not altered by added colloids. Up to the time they approached maturity, tomato plants in sand cultures with added methocel grew better than those without. From then on, apparently, water was withheld from the plant sufficiently to cause some wilting and retardation of growth.

STUART DUNN

VEGETABLE PRODUCTION

Factors Affecting the Storage of Squash

The results of current investigations concerned with factors affecting the keeping qualities of stored squash agree with previous recommendations. These follow in brief: (1) cut stems short, (2) move immediately to storage, (3) heat the storage for a curing period of two weeks, (4) maintain permanent storage temperature at 50° to 60°F, (5) frost and bruising are more serious than cuts, (6) molds develop under cold storage conditions even though the air is kept dry, (7) squash lose more than one-half their food value within a few months although the weight is reduced only 15 per cent, (8) freezing or canning should be done within a few months after harvest.

The Department of Agricultural and Biological Chemistry, cooperating, finds that nearly two-thirds of the food carbohydrates were lost during six months of storage, based on change in weight of the whole squash and on an analysis of the edible portion. To determine changes in other parts of the fruit, the fiber and seeds were separated, weighed and sampled, and the edible portion was sampled. No quantitative method could be devised for separating the skin, thus, its weight was included with that of the edible portion, though it was not included in the sample analyzed.

Samples of three varieties (Blue Hubbard, Buttercup and Butternut) were taken at harvest and after two weeks' and three months' storage, and of Blue Hubbard after six months' storage. Analysis of 30 or more samples is in progress.

A. F. YEAGER, T. G. PHILLIPS, M. C. RICHARDS, R. EGGERT

Varietal and Cultural Investigation

The northern New Hampshire trials at Colebrook have revealed a few facts of considerable interest. The White Mountain watermelon, recently developed at the Experiment Station, ripened successfully at Colebrook. Production of Early Chatham tomato has been successful and it is hoped that the Bush Buttercup squash will prove itself during 1945. It was observed that newly broken ground was not so inducive to good beet production as ground that had been cultivated for some two or three years.

Early Chatham, a variety resulting from the tomato breeding project, has made possible successful tomato production in the northern section of New Hampshire, and they are now grown there by the thousands. Continued work toward the development of better early varieties is being continued both at Colebrook and at Durham. The production of tomatoes with a high vitamin C content is now being given much time. Marketable tomatoes with three times the vitamin C content of ordinary varieties were produced in 1944. Selections for the purification of this characteristic are being continued. Tiny Tim, named in 1944, probably the smallest variety of tomato grown as far as plants are concerned, has proven popular in some places as a house plant and as a novelty for home gardens, although another variety named last year, Window Box, which has a plant 18 inches in height with fairly good-sized fruit, is better adapted for such a purpose. Some home gardeners have found it useful for their early garden crops.

Thirty-eight lines of Lima beans have been purified by growing them several generations in the greenhouse. These are being tested for performance in the field and the best will be ready for multiplication during the summer of 1946. An early lima of the potato type with large, green seed, is the objective.

Butternut squash continues to be an outstanding variety among those tested, both for home and commercial production. Merrimack Wonder pepper is particularly adapted to this region.

A. F. YEAGER, H. S. CLAPP, W. D. HOLLEY

Treatment of Seeds with Hormones And Hormone-like Preparations

Various concentrations of urea were tried on green pencil-pod beans, lettuce, radish, and Swiss chard. Treatments were: dry, control, 10 per cent urea solution, 50 per cent urea, 100 per cent urea, all for three hours, planted in soil in bulb pans. The controls gave the largest number germinated, otherwise, there was little difference in the beans. The other seed showed adverse effects from the urea, increasing with greater concentrations.

Trials with methocel plus hormone solutions were made with onion and bean seeds. It was thought that methocel, a hydrophillic colloid, might make the hormone more slowly available. A 5 per cent methocel solution was used and to this was added 0.1 *gm.* of p-chlorophenoxyacetic acid per 50 *ml.* Onion seed were soaked in this for four hours and kidney beans for six hours, and then planted in soil. None of the hormone-treated seed came up, and about 90 per cent of the controls germinated.

A 5 per cent methocel solution with the various concentrations of urea noted above was tried on pencil-pod beans, each for one hour. Again, the urea effect was adverse, increasing with concentration.

Cut seed pieces of potato were tested with 5 per cent methocel with various substances: methoxyacetic acid, p-chlorophenoxyacetic acid, p-thiocresol, indolbutyric acid, methocel alone, and controls; all were at

0.005 per cent. The seed pieces were dipped in the solutions for 10 minutes and then planted in sand in flats. The p-thiocresol and indolbutyric acid showed toxic effects, but the others were similar to the controls. The few survivors of the p-thiocresol treatment grew more vigorously than others.

STUART DUNN

STATE SERVICE

Inspection of Fertilizers and Feedingstuffs, and Soil Testing

In accordance with the public statues regulating the sale of commercial fertilizers and of concentrated commercial feedingstuffs, 36 brands of fertilizers and 233 brands of feedingstuffs were analyzed during the year 1944-45. These analyses involved individual determinations totaling 225 and 1822 respectively. Studies on the determination of riboflavin, mentioned last year, have been continued, and some work has been done on the determination of choline. Co-operation in work on analytical methods with the American Association of Feed Control Officials and with the Smalley Foundation has been continued.

Miscellaneous samples of feeds, fertilizers, and other materials have also been analyzed for residents of the state. Over 100 samples have been examined, involving some 360 determinations. Cases of suspected livestock poisoning have been more numerous than usual.

Over 900 samples of soils have been tested for residents of the state, an appreciable increase over 1943-44.

T. O. SMITH, H. A. DAVIS, G. P. PERCIVAL

Seed Inspection

The new seed law requires that all agricultural and vegetable seed shall have been tested for germination within nine months of the time it is offered for sale. Samples of carried-over seed, therefore, were received during the fall and winter of 1944-45. From October 16 through April, with a few samples straggling in during May and June, 1309 private samples have been tested. These are samples of carried-over seed sent in by dealers and 25 or 30 samples of corn and beans raised by farmers who wished to sell them for seed.

The Commissioner of Agriculture authorized the seed analyst to make inspection trips, and, as a result, 172 official samples were collected and 47 stores visited in this section of the state. Since June first, the seed inspector has brought in 62 more official samples, making a total of 245 official samples tested this season, which will be reported in Station Bulletin 357. Much can be accomplished by working with the dealers in cases where they have been a little thoughtless or careless about keeping the proper labels with the seed or are keeping seed over from year to year,

sometimes without retesting, and sometimes not changing the "date tested," even though they have complied with the law by having it retested.

Last fall and winter, considerable work was done with squash-seed germination in co-operation with Dr. M. C. Richards of the Department of Botany. Twelve different seed treatments were examined in an effort to control excessive growth of mold during germination. The following showed promise and will be used further:

1452F (7.7% ethyl mercury p-toluene solfonanilide)
Spergon (Tetrachloro-para-benzoquinone)
Arasan (Tetramethyl Thiuramdisulfide)
New Improved Ceresan (Ethyl mercury phosphate 5%)

Three lots of referee samples have been run — one on the germination of soybeans, one on endive, and one on New Zealand spinach. This study of different methods for germinating New Zealand spinach is especially interesting because it is one of the most difficult seeds to germinate in the laboratory, due to the spongy covering on the seed. The present method prescribes running the test 28 days in moist sand. Boxes of sand are heavy, require more space than blotters, and hold that space for a month; thus, a shorter method would be more helpful.

B. G. SANBORN

Potato Seed Certification

Aid was given the State Department of Agriculture in the field inspections of potato fields proposed for certification in the Colebrook area. Two inspections were given during the growing season to the total of 130 acres and all passed. The work was done jointly with C. A. Lyon, Inspector in the Bureau of Markets. It is expected that Mr. Lyon will now carry on the work alone.

Another change was inaugurated in regard to testing samples of seed potatoes. Instead of a greenhouse test at Durham, arrangements were made by the Commissioner of Agriculture to send samples, along with those of New York state, to Florida for a disease reading.

STUART DUNN

Autopsies at Poultry Laboratory

During the fiscal year 1944-45, 2290 specimens, plus 312 milk samples, were submitted to the Poultry Laboratory for diagnosis. These consisted of 928 cases and eight lots of milk samples.

A total of 1951 chickens were examined, 1692 (520 cases) from poultrymen and 239 from the University of New Hampshire flock. The remainder of the specimens consisted of 256 turkeys (86 cases) and 83 miscellaneous specimens.

A. C. CORBETT, D.V.M.

Pullorum Testing

To control and eliminate pullorum disease from the poultry population of New Hampshire this laboratory ran agglutination tests on the blood of 1,244,985 hens. In addition, 85,542 retests were made on infected flocks. This made a grand total of 1,330,527 samples during the past fiscal year.

Of approximately 750 flocks tested, infection was found in 27 flocks. Of the 27 reacting flocks, 12 were tested for the first time or had suffered infection during the previous year. The 15 remaining flocks were classified as breaks in that they had previously been free of infection.

F. E. ALLEN

Manufacture of Fowl-Pox Vaccine

The manufacture of fowl-pox vaccine by chick-origin method was discontinued during the past fiscal year because of outbreaks of Newcastle disease in this country. This disease has apparently been introduced from Europe and to prevent its spread the Bureau of Animal Industry has ordered all poultry vaccines to be produced by the egg-embryo method. The department was allowed to sell the vaccine manufactured prior to the date of the above order and our sales for the past fiscal year amounted to approximately 345,000 doses.

F. E. ALLEN

Infectious Bronchitis Work

During the year, several thousand birds were immunized against infectious bronchitis. Live birds infected with bronchitis were taken to the farms for the inoculation work.

The office of the state veterinarian has limited the use of this virus to farms where the infection has existed in the past.

F. E. ALLEN

National Poultry Improvement Plan

The National Poultry Improvement Plan is in operation in 45 states. Its purpose is to set up uniform standards throughout the country for hatching eggs, baby chicks, and breeding stock. The official agency in this state is the New Hampshire Poultry Improvement Board, Inc. which consists of 10 members from the industry. Co-operating with this agency are the Agricultural Experiment Station at the University of New Hampshire, and the State Department of Agriculture. The four progressive breeding stages of the plan are administered by the Poultry Department at the University.

These stages from the lowest to the most advanced are: Approved, Certified, Record of Performance (R. O. P.) and Register of Merit (R. O. M.) All stages of the plan showed a large increase over the previous year. Sixty-three additional poultrymen qualified as Flock Selection Agents bringing the total to 250.

Approved. Two hundred and eighty-four flocks with a total of 519,116 birds were approved during the year. This is an increase of 125 flocks and 282,367 birds over the previous year.

Certified. Seventeen flocks with 34,951 birds were certified, an increase of two flocks and 200 birds.

Record of Performance. (R. O. P.) During the 1943-44 R. O. P. year, there were 13 poultry flocks on 10 farms and one turkey flock under supervision. Of the 5,281 birds entered 2580 or 49 per cent qualified as U. S. N. H. R. O. P. The 1944-45 R. O. P year has 14 poultry flocks on 11 farms plus two turkey flocks under supervision. Trapnesting includes 6031 chickens and 400 turkeys.

Register of Merit. The R. O. M. is the most advanced stage of the National Poultry Improvement Plan. Females that have qualified for R. O. P. are individually mated to R. O. P. males in single male matings and the eggs and chicks are pedigree hatched. Under R. O. P. the performance of the daughters of these matings qualifies the dams and sires for R. O. M. New Hampshire breeders had 2744 birds in 200 special matings during the past hatching season.

E. T. BARDWELL, T. B. CHARLES

Dairy Bacteriological and Mastitis Testing

For the year ending June 30, 1945, 227 samples of milk have been tested for bacteria, over 200 for butterfat and 53 for total solids.

Other services conveyed under Bacteriology Testing include the calibration of Babcock glassware and the supplying of the Babcock glassware to the D. H. I. A. testers.

During the year, 789 milk test bottles and 460 pipettes were calibrated.

H. C. MOORE

A total of 419 samples of milk submitted by New Hampshire dairymen and veterinarians were diagnosed for bovine mastitis.

L. W. SLANETZ

Expenditures for the Year Ending June 30, 1945

	Hatch	Adams	Purnell	Bankhead-Jones	Supplementary*
Personal Services	$10,159.16	$14,038.36	$51,486.37	$7,047.25	$33,319.51
Travel	647.31	114.52	1,552.49	677.03	1,508.89
Transportation of Things	315.61	22.78	155.44	3.02	164.57
Communication Service	479.04	7.46	54.85	14.49	429.18
Rents and Utility Services	700.00	130.00	284.10	136.70	----
Printing and Binding	765.96	----	702.35	35.87	100.00
Other Contractual Services	607.63	109.59	1,160.54	56.24	437.75
Supplies and Materials	704.42	416.34	3,196.34	526.85	3,289.43
Equipment	620.87	160.95	1,407.52	9.95	320.93
Lands and Structures (Contractual)	----	----	----	----	----
	$15,000.00	$15,000.00	$60,000.00	$8,507.40	$39,570.26

*This fund includes monies from the following sources:

State Appropriations Bankhead-Jones Offset	$ 8,507.40
Miscellaneous Income	30,296.90
Federal Sales	765.96